2008

Preparing tomorrow's teachers today

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Preparing tomorrow's teachers today

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This thesis is presented in fulfilment of the requirements
for the degree entitled a Professional Doctorate in Education

Faculty of Arts and Education
EDITH COWAN UNIVERSITY

Supervisor: Dr Tony Fetherston

April 2008

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

ABSTRACT

This portfolio documents the learning journey of a preservice teacher educator in Western Australia. The problem investigated is how should we best to prepare preservice teachers for teaching in future contexts. This document has several sections, firstly the literature review discusses topics that have relevance for teacher educators preparing teachers of the future to work in a knowledge-based economy. Then four phases of research both quantitative and qualitative are presented interlinked by a personal narrative. The narrative describes how the studies and research impacted on the teaching practices of the researcher. The powerful findings of the research with teachers in phase 1 and preservice teachers in phase 2 precipitated the reconceptualisation of a number of courses for preservice teachers co-ordinated by the author. This lead to the transformation of the instructional model used and the incorporation of a range of flexible delivery modes to support student learning styles and needs and foster student engagement and retention.

The portfolio also contains descriptions and results of a number of small research projects, five peer reviewed and published papers. Reference is made to a number of peer reviewed academic conference papers presented by the researcher linked to the theme of the portfolio. The portfolio culminates with two peer reviewed publications which describe the current state of preservice teacher education in Western Australia as well as presenting a future vision of how we could prepare our preservice teachers to work in a future digital world.

The over riding conclusion reached in this portfolio is that preservice teacher educators need to experiment with flexible modes of delivery to meet the learning needs and styles of our students. In this way we will be modelling flexible modes of teaching to our students to prepare them to teach in future contexts.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i) Incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution or higher education;

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ACKNOWLEDGEMENTS

I would like to acknowledge the support of my supervisor Tony Fetherston for his encouragement and support. I would also like to thank the teaching team in the doctoral program at ECU for sharing their expertise with me so freely over the past five years. A special thank you to Terry De Jong, Jan Gray, Bridget Leggett, Graeme Lock, John Hall and Heather Sparrow for their continual encouragement and mentoring.

I would also like to thank all of my colleagues at ECU for all their positive support and advice during this process. Thanks to Alistair Campbell for his technical advice and contributions. Finally I would like to thank my super supportive family Frank, Nicola and Josh for many cups of tea, wonderful meals and life saving walks along the beach.

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Preparing tomorrow's teachers today.

1.2 Keywords

Knowledge-based economy
Learning styles
Digital video analysis
Pre-service teacher education
Gender and learning
Technology and learning
Future educational planning
Brainworks

1.3 Introduction to the portfolio

Ch 1 Introduction	**Ch 2** Lit review	**Ch 3** Research Phase1 Teachers	**Ch 4** Research Phase 2 Preservice Teachers	**Ch 4** Research Phase 3 Post Grad Students	**Ch 4** Research Phase 4 Technology in teaching	**Ch 5** Future of Teacher Education	**Ch 6** Conclusion

Figure 1: Portfolio progress chart chapter 1

This doctoral portfolio contains the evidence of a professional learning journey travelled by the author over a period of five years. I write from the perspective of a tertiary educator. I currently work in Perth, Western Australia as an academic at a university that has the largest teacher education department in the state. I am the co-ordinator of a post-graduate course in teacher education. In this course students with any degree can train to be a teacher in one year. I also teach units on inclusive education and curriculum studies in the four-year undergraduate course for pre-service teachers.

This exciting learning journey starts with my arrival in a new country, Australia in 2003. I had just completed my master's degree in inclusive education in South Africa after working in the education sector as specialist teacher in learning disabilities for over twenty years. As a means of consolidating my learning and familiarising myself

with the educational conventions of a new country I embarked on a professional doctorate in 2004.

The professional doctorate included six units of course work, EDU7101: Methods of Investigation, EDU7102: Learning in the Knowledge Society, EDU7103: The Governance of Education Institutions, EDU7104: Education and the Global Economy, EDU7105: Curriculum in the Knowledge Society. The work completed in these units of study culminated in this professional portfolio. Alongside the successfully completed research and studies required in each unit of coursework, I have also completed a number of research projects, presented at academic conferences, designed and presented professional development for teachers and written new courses for pre-service teachers. I have had five peer-reviewed articles published. I have contributed a chapter entitled "Teaching the net generation-using digital technologies to accommodate student learning styles in a tertiary setting" to a book called "Innovative practices in pre-service teacher education: An Asian-Pacific perspective" which is currently in press. Three more peer-reviewed papers that I have written based on the research in this portfolio for national and international conferences in 2008 are currently under review.

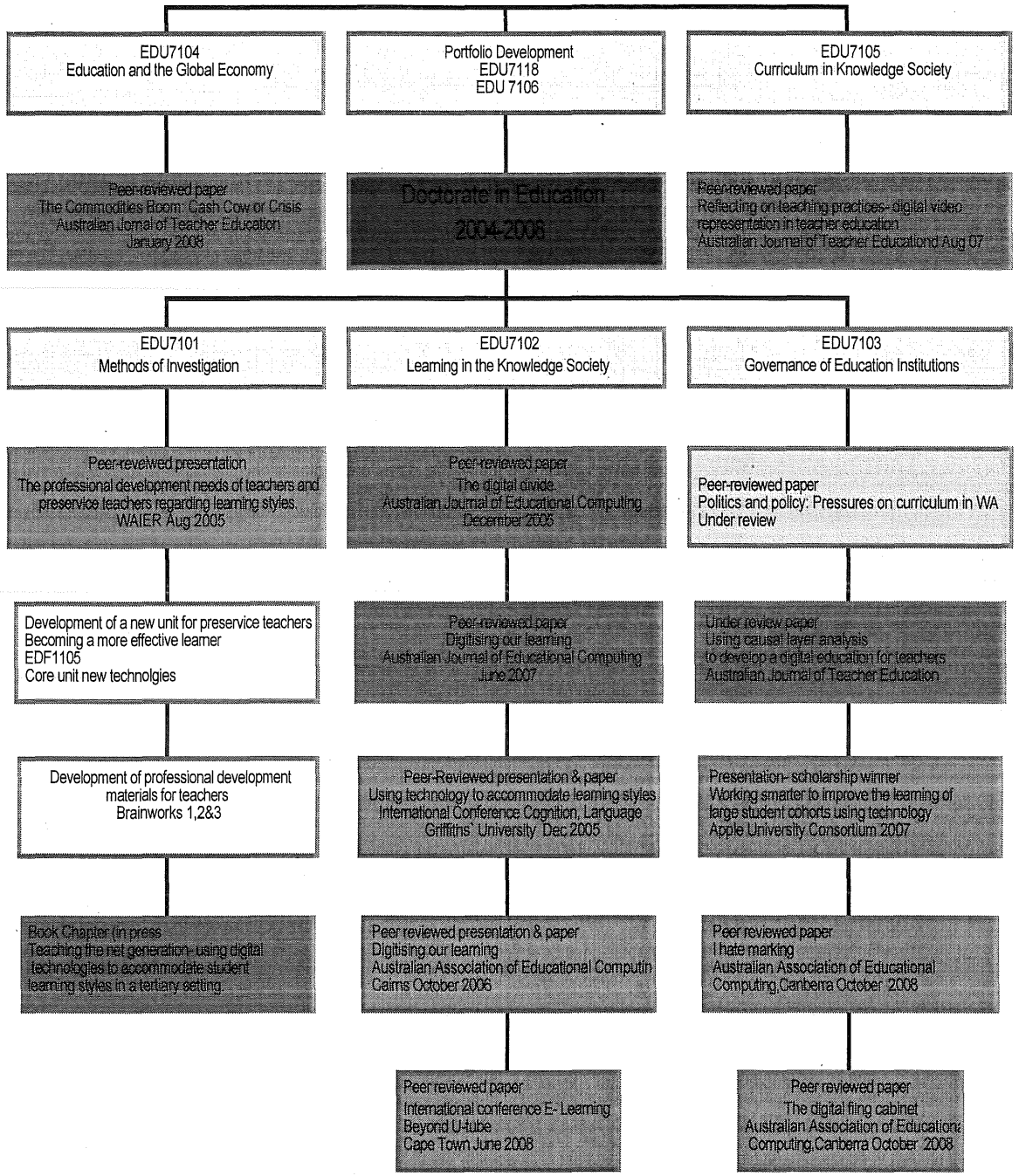

Figure 2: An organisational chart showing the outcomes of the portfolio

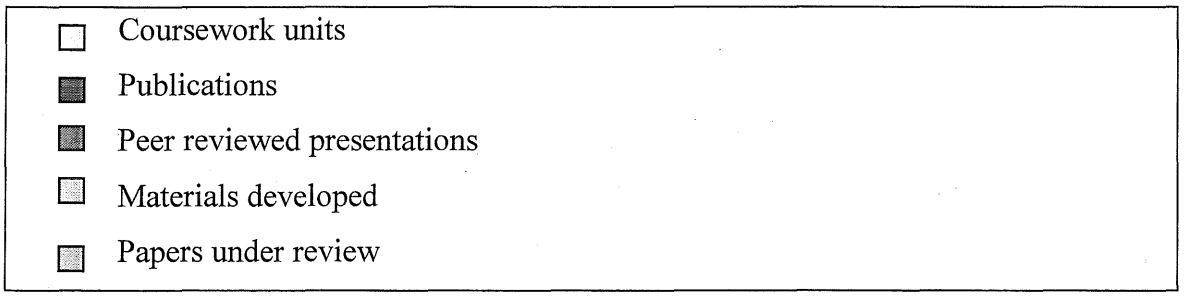

Figure 3: Key to the concept map

I have used colours to indicate the academic activities developed as outcomes of the work done in this professional doctorate. The yellow boxes represent the units of coursework completed in The Professional Doctorate of Education. The red boxes show peer-reviewed published journal articles I have written which developed from the work done in the course work units. The purple boxes show four peer-reviewed academic conference presentations I have given, in which outcomes of the research were presented. The white boxes give evidence of other outcomes from the research, a book chapter, professional development materials for teachers and new unit for pre-service teachers using new technologies to accommodate students learning styles. The grey boxes show papers currently in press. There are three other papers based on this research that are currently under review.

The progress chart shows how the portfolio developed. This chart will be used throughout the portfolio. The section under discussion will be highlighted in yellow to guide the reader through the portfolio.

Ch 1 Introduction	**Ch 2** Lit review	**Ch 3** Research Phase1 Teachers	**Ch 4** Research Phase 2 Preservice Teachers	**Ch 4** Research Phase 3 Post Grad Students	**Ch 4** Research Phase 4 Technology in teaching	**Ch 5** Future of Teacher Education	**Ch 6** Conclusion

Figure 4: Progress chart showing the development of the portfolio

The work presented in this portfolio is a culmination of over twenty-five years of experience as an educator. It is informed by my personal professional qualifications. In addition to my initial teaching qualifications I have completed a post-graduate diploma in clinical remedial education, learning difficulties, an honours degree in educational psychology and a masters degree in education psychology stream specialising in inclusive education. My particular interest is in the field of cognitive psychology looking at the interceptions between neuroscience, psychology, learning styles and technology. This will be expanded in the literature review in chapter 1.

Through my studies and work as a consultant in schools supporting teachers to implement new curriculum changes in the move to outcomes based education and the move to inclusive education in both Western Australia and South Africa, I realised that teachers in South Africa and Australia were faced with very similar challenges. They were being expected to work in new paradigms, using curricula that they did not fully understand expected to teach children who had a wide range of learning needs. The new curriculum in Western Australia included concepts such as individualised learning and catering for the learning styles and needs of the students. The following quotation

describing the expectations that teachers cater for children with learning differences is in the introduction to the Curriculum Framework, p.17.

> Inclusivity means providing all groups of students, irrespective of educational setting, with access to a wide and empowering range of knowledge, skills and values. It means recognising and accommodating the different starting points, learning rates and previous experiences of individual students or groups of students (Curriculum Council, 1998).

This curriculum assumed that existing and future teachers had deep understandings of these concepts. In reality the majority of existing teachers were trained to implement content-based curriculum, which emphasised whole class learning using syllabus documents to guide teachers in what needed to be covered in a period of time. The move to a knowledge-based economy has necessitated changes in emphasis in curricula. This work on the changes in curriculum will set the context to the investigations in phase 1 of the research documented in chapter 3.

One of the focus points in the Curriculum Framework in Western Australia is on metacognition, the understanding of learning and thinking processes and individualisation; catering for the learning needs and styles of learners. This is clearly seen in the quotation below which comes from the Curriculum Framework documentation produced by the curriculum council in Western Australia.

> Learning is likely to be enhanced when the learner engages actively with the task at hand. Students should be encouraged to think of learning as an active process on their part, involving a conscious intention to make sense of new ideas or experiences and improve their own knowledge and capabilities, rather than simply to reproduce or remember. This means that learning experiences should be potentially meaningful and involve students in both doing and reflecting (Curriculum Council, WA. 1998. P.34)

After spending many hours in schools with teachers I realised that there were a number of areas relating to teachers understandings of these concepts expressed in the curriculum framework namely that of students being active participants reflection on their own learning and engaging and participating in the process of learning active which needed further research, explanation and investigation. The concepts expressed above are the underpinnings of a conceptual shift in the design and outcomes of this curriculum. Yet my concerns were that many teachers did not fully grasp the implications of these statements, as they would imply a different way of teaching to the way many teachers had taught in the past where the emphasis lay on the transmission of

information and the reproduction of that information by the learners. This led to the first phase of the research components in this portfolio, entitled " Effective learning research with teachers in Western Australia" phase 1 "My thoughts on learning". This project grew and evolved over a four-year period to include work with pre-service teachers. The components and outcomes of this research will be described in detail in chapter 3 of the portfolio.

There are also expectations in the Curriculum Framework in Western Australia that teachers embed new technologies in their teaching. This need for teachers to be confident users of technology prompted the work done in this portfolio using new technologies with pre-service teachers as described in phase 2 of the portfolio. These expectations embedded in the Curriculum Framework for Western Australia can be seen in the quotation from the Curriculum Framework (Curriculum Council, WA. 1998, p.17).

> It must also be responsive to social and technological change and meet students' needs arising from that change process. In particular, it must encourage effective use of new technologies as tools for learning. The Framework provides a balance between what is common to the education of all students and the kind of flexibility and openness required for education in the twenty-first century (Curriculum Council, 1998).

Once I had completed phase 1 of the research investigating teachers` understandings, I realised that there were gaps in the understanding of these concepts for the pre-service teachers. I then initiated research with pre-service teachers. Phase two of the research project will be described in chapter 4 of the portfolio along with details of the outcomes of this research. The results of phase two with undergraduate pre-service teacher prompted me to investigate the learning styes and needs of my post-graduate students. This small investigation is documented as phase 3 of the research and documented in chapter four of the portfolio.

The results of phase 2 and phase 3 of the research investigating the understandings and learning needs of pre-service teachers revealed important information, which led me to reflect on my own teaching. These reflections led to a number of exciting changes in my pedagogy to cater for the learning styles of my students both under-graduate and post- graduate university students studying teacher education courses. I used the professional readings as a catalyst to frame and shape my own professional practice as a teacher educator. The findings of the research projects

helped develop and refine my professional work venturing into new avenues as the findings revealed that my students learning needs were growing and changing in response to technological and environmental changes.

The portfolio reflects my personal learning journey this started by my investigating the understandings about learning in the practice of classroom teachers and lead to my investigation of my own practice as a tertiary educator of pre-service teachers. This is the area in which has resulted in substantial changes in my pedagogy as I have consulted the literature, listened to the voices of my students and researched their learning styles and needs. By analysing the data from my students I have realised how different their learning needs and styles have become and have made significant changes in my teaching to accommodate the students learning styles and needs. This has resulted in very innovative work with online portals, digital video analysis, podcasts, vodcasts, social networking sites, electronic filing systems which will be described in chapter 4.

The readings and work done in preparing the portfolio raised some deep concerns about the future directions of education in Western Australia particularly pre-service teacher education. This led to a series of reflective papers on current problems and future scenarios for pre-service teacher education in Western Australia, which are presented in chapter 5. In concluding this portfolio I came to the realisation that this is not the end but the beginning of a new journey thus later in chapter 6 areas for future research are presented and some overall conclusions from the whole portfolio are discussed.

CHAPTER 2

Literature review and background

Ch 1 Introduction	Ch 2 Lit review	Ch 3 Research Phase1 Teachers	Ch 4 Research Phase 2 Preservice Teachers	Ch 4 Research Phase 3 Post Grad Students	Ch 4 Research Phase 4 Technology in teaching	Ch 5 Future of Teacher Education	Ch 6 Conclusion

Figure 5: Chapter 2 portfolio progress map

Thinking, learning and teaching are the keystones of our educational system. One widely accepted purpose of education is to develop the individual learning potential of the learners to enable them to become independent critical thinkers capable of performing in our rapidly changing society (Hargreaves, 2003; Quicke, 1999).

The Curriculum Framework for Western Australia supports the philosophy that all students are to be equipped with the skills to enable them to cope in a changing world (Council, 2001; Curriculum Council, 1998). Teachers, according to this framework are encouraged to develop teaching and learning programs according to the individual needs and characteristics of their students. A dilemma for teachers is that is it difficult for them to keep pace with the current research on thinking and learning and this information was not included in the curricula when many teachers were trained. There is so much information available teachers can become overwhelmed and lacking a sound theoretical background in cognitive science and neurology it is difficult for them to determine what is good practice or merely a passing fashion. In this literature search some of the programmes currently available will be described and compared, listing the educational implications.

The literature is examined to give a historical overview of the field of cognitive science. This serves to give the theoretical background to the portfolio. Further reading examines research on cognitive processing and how this research supports the understanding of different learning styles. This research is analysed from an educational perspective to see what significance this knowledge has for educators.

The literature on the role of metacognition is be briefly discussed as one of the research projects in the portfolio investigates the teachers` metacognitive understanding of their own learning and thinking styles and the learning and thinking styles of the students in their classes.

One of the limitations of this literature review is that the work is mainly of significance to teachers and has a direct implication for teaching. There is a vast body

of literature available on the topic of learning and thinking not all of which has direct relevance for teachers, much of the more technical literature has been excluded from this study as it has more significance for neurologists and cognitive scientists than educators.

2.1. Research in the area of cognitive science

A search of the literature reveals that researchers have been grappling to understand the complexities of thought and human cognition for many centuries. The fascinating nature of thought and the workings of the brain have always been a challenge for researchers, educators and philosophers.

Scientists have tried to understand the workings of the brain for a long time. The work of Gall in the 1700`s involved a primitive form of brain mapping. This was called organology or phrenology (Mundale, 1998). This involved dividing the brain into areas or organs which each had specific functions. These areas correlated with the shape of the skull. Gall thought that the size of an area of the brain equated with the degree of skill of that area in that individual. Gall also stated that the shape of the brain followed the shape of the skull and that areas of the brain could be identified as bumps in the skull. Although Gall's theories have been disproved by modern scientific methods he did initiate the concept of brain mapping and cerebral localization.

Brodman further developed this research in the late 19th century. His research was advanced by the improvement in microscopes and techniques for staining neural tissue. Brodman examined differences in cellular structure leading to differences in function. He identified forty areas of the human cortex. His map developed in 1909 is still used today. Brodman was also the first to identify the six layers of the human cortex (Gazzangia, Ivry, & Mangun, 2002; Mundale, 1998). In the figure 4 is a copy of Brodmans` map accessed from http://spot.colorado.edu/~dubin/talks/brodmann/brodmann.html on the 14/02/2008

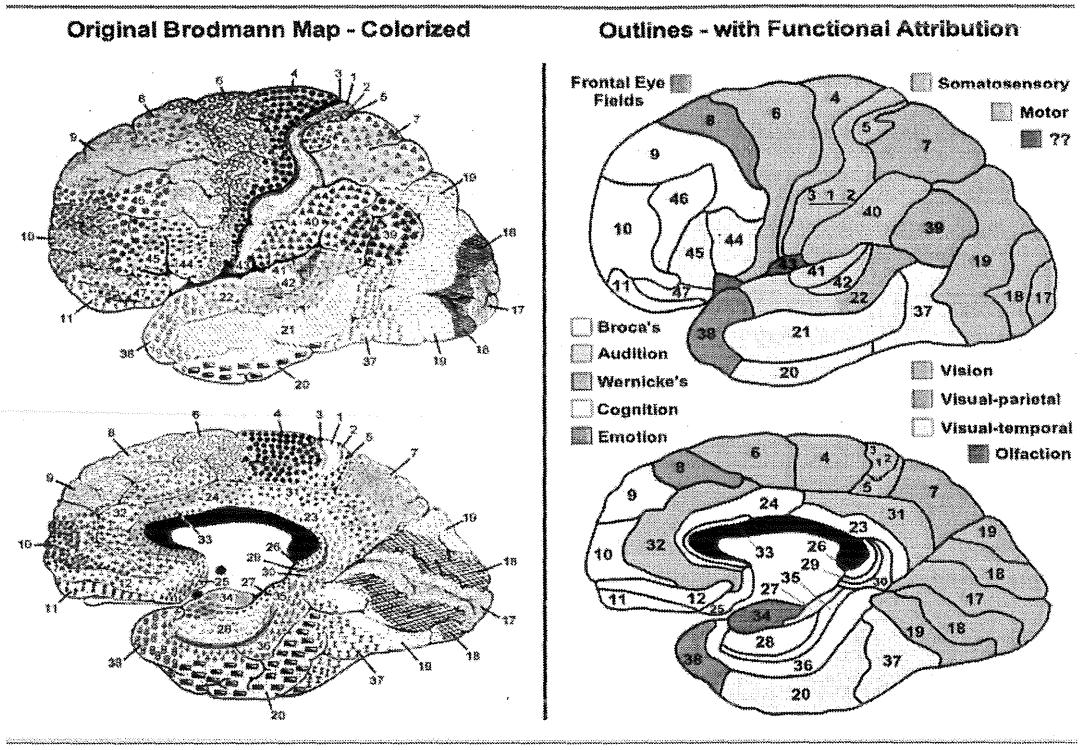

Figure 6: Brodman`s Original Brain Map

Current research using electron microscopes and dyes and tracing agents means neural pathways can be mapped. The knowledge of neural connections helps researchers plot the flow of information between different areas in the brain. In the past researchers had to rely on patients with brain injuries to do their research. They would observe the behaviours of these patients and make hypothesis based on which areas of the brain were visibly damaged. They would them have to wait until the patient died to dissect the brain to determine the full extent of the damage. This is the method Broca used in 1871 to determine the location of Broca`s area in the left frontal lobe of the brain which controls language production and speech (Gazzangia, Ivry, & Mangun, 2002; Pinker, 1999). Researchers using neuro-imaging have examined the brain on which Broca based his research and found the area of damage to be much larger than Broca originally reported in his research, it is possible that they have different definitions of degrees of damage. However it would be logical to assume that the methods available today allow for more accurate localization of areas of the brain and the activities they control.

Modern day brain mapping uses sophisticated techniques to detect the different chemicals present in different areas of the brain. The concentrations of specialized enzymes, neurotransmitters and metabolic by products help scientist to determine the level and nature of the metabolic activity occurring that brain structure

(Bechtel & Graham, 1998).

A new technique "single neuron electrophysiology" (Mundale, 1998) can record the electrical activity of a single brain cell. Neuro-imaging tools such as Functional MRI (fMRI) allow research to match tasks with the activation of specific areas of the brain. Researchers have developed a grid system for mapping brain areas. Through the use of brain mapping scientists have been able to localize brain areas involved in sensory acts but there is still confusion over the location of higher order functions such as memory, consciousness and attention.

2.1.2 Neurology, technology and brain research

The influence of computer technology and research into artificial intelligence is attributed to major development in models of cognitive processes. The current research utilizing PET Scans and MRI imaging provides fascinating examples of how brain processing occurs (Gazzangia, Ivry, & Mangun, 2002; Kellogg, 2003; Wiles & Wiles, 2003). The research into artificial intelligence AI is shown to have made a major contribution towards understanding human thinking and learning. This research will contribute towards the conceptual model in this portfolio.

In the literature review two different models of cognitive processing are compared, the information processing model and the neural net model (Abrahamsen, Graham, & Bechtel, 1998; Johnson, 1993; Pinker, 1999). The information-processing model compares the functions of human brain to those of a computer (Guenther, 1998a). This model is fairly simplistic with an input, a central processing unit and outputs. The computer model is governed by rules. In the information processing model the activity of each unit is dependant on the correct functioning of the preceding unit. If there is an error or breakdown in any stage of the process correct processing will not occur. The neural net model behaves more like a natural brain. The processing is not governed by a central processing unit. The neural net model consists of a large number of processing units, which work in a net like formation. The neural net model is also called a connectionist model or a parallel distributed processing model (Guenther, 1998a).

This model is said to describe the processing of the brain more accurately as it reflects the vast number of neurons that work in an interconnected network to process and store information (Gazzangia, Ivry, & Mangun, 2002; Guenther, 1998a; Mundale, 1998; Wiles & Wiles, 2003). The neural net model reflects the neural plasticity which

current research has shown to be evident in the human brain (Johnson, 1993). The neural net model can be adjusted to strengthen the neural connections between units, which reflect the way in which the strength of connections between neurons alters to meet the current demand.

In a neural net model the processing units transmit signals to each other. These signals cause other units to turn on or off. The rate of response is called the firing rate. This reflects how real neurons react to stimuli by sending electrical impulses down their axons. This flexibility reflects how children learn in real life situations. New neural connections form through the stimulation of the current events. Children can learn new language structures without having explicit rules but just through exposure to real life situations (Gazzangia, Ivry, & Mangun, 2002).

The description of memory using a neural net model differs from an information-processing model. In an information processing model memory capacity is limited by the storage capacity of the brain (Wiles & Wiles, 2003). In the neural net model memory does not imply that a record of experiences are stored in a specific location. In this model memory is distributed in the changing neural connections activated by a specific event or experience (Kellogg, 2003). The implications of this theory for teaching would be to design teaching and learning experiences that evoke strong neural connections in as many areas and levels of the brain as possible this will aid recall (Guenther, 1998b; Kornhaber, Fieros, & Veenema, 2004; Worrall, 2002).

2.1.3 Research on the nature of intelligence

Research has been conducted on the physiological basis of intelligence. Researchers have proposed that the brain of a highly intelligent person has more synapses between neurons (Guenther, 1998b). At this stage more research is being conducted in this area to investigate this supposition. Another speculation is that smart brains are more efficient on a metabolic level (Guenther, 1998b; Mundale, 1998). Using positron emission tomography (PET scans) researchers have shown that people who do better on intelligence tests display a lower neural metabolic activity rate. The researchers have speculated that people who are good at reasoning tasks have more efficient neural circuits (Guenther, 1998b) and therefore use less energy than the people who have trouble with the tasks.

Though this research shows differences in neural metabolic rates it does not tell us what makes neural circuits more efficient. In research by Haier, Siegel, McLachlan,

1992 cited by Guenther, 1998 the metabolic rates of people were measured when they were learning a new task and later when they had mastered the task. This showed higher neural metabolic rates when learning a new task and lowered rates when they had practiced the task. The people who showed the greatest drop in metabolic rates were those who had improved the most on the task. This can indicate that through practice neural activity becomes more efficient requiring less energy to perform a task. An implication of this research for teaching would be the importance for teachers to provide opportunities to practice tasks in order to improve neural efficiency.

2.1.4 Cultural differences in cognition

In Western Australian schools today there are learners from a wide range of cultural groupings. Current research is indicating that there can be cultural differences in cognition. The relationship between culture and the mind is called cultural anthropology. Nuckolls (Nuckolls, 1998) raises the premise that people from different cultural groups perceive things in different ways, for example Nuckolls research reveals that Western children group objects first by colour, then by shape and later, when they are older, by function. Western adults group mainly by function in contrast African adults group objects by colour. Thus the cultural of the individual impacts on the way they perceive, think and learn. Teachers need to be sensitive to these cultural differences when planning learning experiences in multi-cultural classrooms.

Research is cited showing that the way we label things influences our perceptions. In different cultures labels vary which can influence perception. Cultural differences are also reported to influence reasoning, memory and judgment. Cognitive schemas are described as internal scripts, which govern future cognition (Nuckolls, 1998). These schemas can be different for people with different cultural backgrounds. Many of these schemas are developed in childhood and continue to unconsciously influence future development. This difference will influence how future knowledge is assimilated.

Research on gender differences in cognition indicate that there are gender differences in brain functioning in which processing of information occurs in different areas of the brain in males and females. Fogarty (1997) reports that males tend to process language in the left hemisphere and emotions in the right hemisphere where as females tend to have a more diverse localisation for language processing. Differences in hormonal levels influence thinking and problem solving. Levels of testosterone

influence competition, self-confidence and self-reliance. Research is indicating in females when progesterone levels are high maths and spatial abilities decrease (Fogarty, 1997). These hormonal differences become more significant after puberty. This will influence the way educators plan programs for upper primary, middle and high school learners. Educators who are aware of these differences in cognition will be able to adapt their learning programs to meet the learning needs of these students.

Research on stroke patients has revealed data on the different hemispheres of the brain and the areas of activity that they control. The concept that the right hemisphere of the brain controls activity on the left side of the body and the left hemisphere of the brain controls activity on the right side of the body is well supported by research (Johnson, 1993; Pinker, 1999). There are theories that certain hemispheres of the brain control specific skills and activities. This information needs to be utilised with care, as this can be a very simplistic view of brain processing. Current research in the theories of parallel processing supports the view that processing occurs in many connected areas of the brain at different cortical levels and is not confined to one isolated area of the brain. The individual nature of human brain tissue incorporating the concept of neural plasticity allows for processing of similar experiences to occur in different locations in different individuals brains. The brain locations of specific areas of processing activity can vary in the brains of left and right handed individuals and also in the brains of males and females(Gazzangia, Ivry, & Mangun, 2002).

2.1.5 Prominent theorists in this field

The Israeli Psychologist, Reuven Feuerstein developed a program called "Instrumental Enrichment". Feuerstein has done much work in the field of cognitive psychology (Burden & Florek, 1989). Feuerstein studied under Piaget but later challenged Piaget`s theories. He was influenced by the work of Vygotsky and Bruner. Feuerstein`s philosophy is to allow the learners to reach their full potential through the use of mediated learning experiences (MLE). Feuerstein and Vygotsky advocated the role of a teacher or peer mediator to guide the learner through the zone of proximal development with support until they are able to perform the activity alone.

Feuerstein developed his program as a response to his work with immigrants to Israel after the Second World War. Many of these immigrants were being labeled as mentally retarded, Feuerstein felt this was not a true reflection of their potential but a reflection of their cultural deprivation (Burden & Florek, 1989). He felt that this was

attributable to the failure of the group to mediate or transmit its culture to the younger generation. He felt it was essential for parents or other adult to teach children how to learn and to understand themselves as learners. Feuerstein believes that all can learn and that many learners are disadvantaged by the education system, as they are not challenged educationally.

He felt this applied particularly to those learners with special educational needs. A key concept of Feuerstein`s philosophy is that of cognitive modifiability. He feels that teaching people how to learn can change the structure of the brain. Feuerstein`s theory is based on social interaction in which an adult or more experienced peer mediates and guides the learning experience for the learner. This is echoes the thinking of Vygotsky in his theories of social constructivism. Feuerstein has also designed as assessment device called the LPAD the Learning Potential Assessment Device.

This utilizes the concept of dynamic assessment in which skills are first taught then tested in order to assess learning potential which can then be generalized to other learning situations. There have been many research projects done on the effectiveness of Feuerstein`s Program which show measurable increases in learning potential and increases in traditional IQ scores.

This has significance for this portfolio as the writer has been trained in the program of Instrumental Enrichment and the fundamental concepts of cognitive modifiability. The role of the teacher as a mediator will form part of the underlying philosophy of the work developed in the portfolio.

Another significant theorist in this area is the Bulgarian, Dr Lozanov who investigated methods of training while subjects were in a very relaxed state of mind (Lozanov, 1995). His research details that people under these conditions were able to memorize and retain more information when compared to a control group who learnt under conventional methods. Research projects undertaken by a research institute called the Pedagogy Research Institute funded by the Bulgarian Ministry of Education support his claims. The research was supervised Professor Sharankov, head of the Department of Psychiatry of the Post Graduate Medical Institute in Bulgaria (Lozanov, 1995).

Lozanov states" the environment can shape the personality sufficiently to make it possible for the individual to put his capabilities to the most valuable use or on the other hand the environment can be so bad that the individuals capabilities are suppressed and extinguished" (Lozanov, 1995). The effects of the influence of the social environment on the individual are discussed. Parallels are drawn between

political influences of group psychology through fear used by dictators. The positive influences of the socially acceptable norms on an individual's behaviour are described.

Lozanov discusses the barriers individuals create on a subconscious level, which can prevent learning occurring. He feels that if a teacher can create a calm relaxed atmosphere in which the students feel relaxed and safe. They will lower these barriers and engage in the learning process (Lozanov, 1995). He postulates that individuals limit their own learning potential by self-imposed limits on their learning abilities. He proposes the use of positive suggestions to motivate the individual to overcome the negative barriers that have been created by society. These methods have been used in accelerated language courses.

Lozanov uses the term "desuggestion" (Lozanov, 1995) which means to free the mind from previous limiting and discouraging suggestions to replace those with motivating encouraging suggestions. He describes the process of educating people into new behavioural and learning patterns. Lozanov states that learning is enhanced when the teacher explains to the learners that their learning potential can be developed and shows them ways of developing their potential. He feels it is the role of the teacher to teach students how to learn in a stress free way. He states that teachers must be "familiar with the variants in unconscious perceptual and thinking processes, so that they can utilize than in the educational process" (Lozanov, 1995). He supports the idea that teachers must be theoretically and practically well trained and able to teach students how to learn. In this methodology the use of music is encouraged. Specific pieces by Haydn Symphony No 67 in F major and No. 69 in B major are used to support the learning.

Some of the ideas and research listed by Lozanov will contribute to the theoretical background of this portfolio. The concepts of developing learners potential beyond their current levels of achievement will form part of the core values in the Portfolio. Lozanov`s research into the concept of removing mental barriers to learning and achievement allowing the individual to achieve new levels of cognitive achievement will contribute to the development of the portfolio theme promoting learning and thinking styles. Lozanov`s research into the use of positive visualization and music to enhance learning correlates with current research in brain function and learning which will contribute to the portfolio theme.

There has been criticism of the work of Lozanov comparing it to hypnotism and mind control. Care needs to be taken and ethical considerations must be strictly upheld when working with children. The boundaries of what is acceptable practice need to be

strictly enforced and monitored at all times. The use of positive visualization is an acceptable technique used extensively by sports psychologists to overcome mental barriers and enhance performance. This technique can be successfully applied in education.

2.1.6 Metacognition

Metacognition refers to higher order thinking, which involves active control over the cognitive processes engaged in learning. Metacognition can be simply described as thinking about thinking. The term metacognition is associated with Flavell (Flavell, 1987). According to Flavell, metacognition consists of knowledge and experiences. Metacognitive knowledge refers to acquired knowledge about cognitive processes; this knowledge can be used to regulate thinking. Flavell divides this knowledge into three categories: knowledge of individual variables, task variables and strategy variables (Flavell, 1987). Knowledge of individual variables includes knowing how people learn as well as knowing your own learning style and processes.

Knowledge of the task involves knowing the nature of the task and what type of mental processes it requires. Knowledge about strategies requires knowing the cognitive and metacognitive strategies as well as knowing when to apply the strategies for optimum success (Livingston, 1997).

The study of metacognition involves examining the cognitive processes involved in learning and determining what makes some learners more successful than their peers. This understanding of metacognition has numerous implications for classroom teachers. On a personal level it will be relevant to investigate the metacognitive insight teachers have of their own thinking and learning processes. This type of deeper metacognitive investigation of one's own learning and thinking style may not have been part of many teachers professional training. The researcher proposes that in order to understand the metacognitive processing of others, a person first needs to have an understanding of their own metacognition. On a second level in order to teach learners to understand manage their learning it is necessary to bring them to understand how they think and learn. In this way by understanding their learning they can learn new strategies and know when and how to apply these strategies to enhance learning (Coles & Robinson, 1989; Fogarty, 1997; Guenther, 1998b).

Sternberg (Baron & Sternberg, 1987) refers to the ability to control one's own cognitive processes as one of the components of his triarchic theory of intelligence.

Metacomponents control other cognitive processes and ensure that they are executed successfully. According to Sternberg the inner knowledge and the ability to control one's cognitive processes is central to intelligence (Sternberg & Ben-Zeev, 2001). All individuals use metacognition to varying degrees when doing tasks. There are theorists who propose that people with greater metacognitive awareness and control can regulate their own cognitive processes and are more successful at cognitive activities. Some cognitive psychologists like Feuerstein, Haywood, Lipman, maintain that these cognitive strategies can be implicitly taught to all students to make them more successful learners (Coles & Robinson, 1989).

Haynes and Haynes (Haynes & Haynes, 1996) reject this view. They state that abstract thinking skills should not be taught out of the context of a purposeful activity. They do not feel that strategies and thinking skills can be taught and tested as part of a curriculum in schools. The view they support is that thinking skills are only relevant within a specific context. The view supported by these researchers is that thinking is a social activity and should be developed within a social context integrated into the regular curriculum. This view is supported by Splitter and Sharp (1995), who stated that the primary focus of educators should be the overall development of the whole individual not isolated skills or dispositions.

To conclude there are different views on the teaching of specific thinking and learning skills and strategies. Educators need to be aware that all learning should be grounded in a context to make it authentic. Feuerstein in his program Instrumental Enrichment proposes that to make learning authentic transcendence needs to occur (Burden & Florek, 1989). This means that the skill needs to be transferred to other contexts to make it meaningful. Both Feuerstein and Haywood include this stage of bridging or transcendence in which learners apply the metacognitive skills and strategies in three other contexts to demonstrate mastery.

2.1.7 The teaching of thinking and learning

There has been work done in this area for many years although much of it seems to be in isolated research projects that have not been sustained. The classic work of Dewey " How we think" (1909) and Glaser's, "An experiment in the development of critical thinking" (1941), and Lipman`s " Philosophy for Children Program" published in 1985. There is evidence in the literature of a number of programs to promote thinking skills used in Britain in the 1980`s. It is of interest to see how much work has been done in

this field for so many years to get thinking recognized as a valuable skill that needs to be included in the curriculum. When one looks at current curricula it is evident that much change still needs to happen as very little direct teaching of thinking skills is happening in schools today.

In Western Australian the writer has observed very little direct teaching of thinking and learning skills. There are schools where private professional development agencies have done courses with the staff resulting in isolated programs with the learners. It seems from observation that unless initiatives are on a whole school approach or instituted on a district level it is difficult for individual teachers to sustain interest in these programs.

Haynes and Haynes were contracted to develop and conceptual framework for critical thinking and problem solving for Western Australian schools in 1996 (Haynes & Haynes, 1996). The framework was not implemented and its current status is that it is still under review. This indicates that the Education Authorities are aware of the need for formalized systematic teaching of thinking and learning skills although eight years have lapsed since the framework was commissioned and nothing has been implemented.

Current readings indicate that the teaching of thinking and learning will be introduced in all schools in Britain from 2005. This indicates the relevance of this research from Australian schools, as there is as yet no program teaching thinking and learning skills in Australian schools. In South Africa pilot programs have been introduced to support curriculum 2005 an outcomes based curriculum framework. These pilot programs advocate the use of various programs to explicitly teach thinking and learning strategies as part of the curriculum.

2.1.8 Classroom strategies

There has been much interest in work in this area for many years. Glaser's classic work, "An experiment in the development of critical thinking" was published in 1941. Dewey's book " How we think" published in 1909 and Lipman`s " Philosophy for Children Program" published in 1985. These works give a valuable overview of pioneering work in this field and the obstacles encountered. It is of interest to see how much work has been done in this field for so many years to get thinking recognized as a valuable skill that needs to be included in the curriculum.

There are many programs which suggest strategies that class teachers can use when planning their instruction in order to meet the learning needs of a range of

learners with diverse learning styles in their classes (Buzan, 1995; Fogarty, 1997; Kornhaber, Fieros, & Veenema, 2004). Other programs suggest teaching cognitive strategies to the whole group of learners in order to develop their range of skills and strategies (Baron & Sternberg, 1987; Burden & Florek, 1989; Coles & Robinson, 1989). Some researchers take the view that discrete thinking skills and strategies should not be taught but that opportunities for critical thinking should be imbedded into authentic tasks as part of the curriculum (Haynes & Haynes, 1996).

Although there are many conflicting views expressed in the literature the consensus is that these thinking and learning skills and strategies do need to be developed and encouraged in our learners. The next point of agreement in the current literature is that not enough stimulation of higher order thinking and learning skills is occurring in classrooms. The writer proposes that a combination of explicit teaching and imbedded opportunities be provided for learners to develop their potential. In the next section a brief overview of the literature on learning styles will be presented.

2.1.9 Learning styles and multiple intelligences

The nature of the debate on learning and thinking is complex and contested. It has been occurring for a long time, philosophers' opinions on the nature of learning can even be traced back to the time of Ancient Greece. Plato was reported to have claimed he could only be considered intelligent because he was aware of his own ignorance. In this portfolio I have selected the construct of learning styles as a way of framing the research with teachers as well as my personal reflections on my own teaching. I have selected this perspective because the Curriculum Framework in Western Australia makes frequent reference to teachers accommodating the learning styles of students (Department of Education, 2005). This topic of learning styles and multiple intelligences is frequently mentioned in current debates on learning in an educational context. I felt it was important to investigate teachers` understanding of this construct of learning styles. Through searching the literature I found that despite the term "learning styles" being widely used in education today there are a range of interpretations and understandings of the term.

It is difficult to determine when the concept of an individual style of learning was first mentioned in the literature. Historically, Hippocrates wrote about four aspects of human nature, which he called humors; blood; black bile; phlegm and yellow bile. He felt that these needed to be balanced in a balanced individual. Carl Jung (1875-1961)

a Swiss psychologist developed a paradigm detailing psychological types or personalities. Jung based his categorization of human personalities on two cognitive processes, perception- meaning how people absorb information and judgment- how that information is processed. Jung described different ways of perceiving information, either directly through real life experiences or abstractly. Jung also described the level of engagement of the individual when processing information as being introverted or extroverted. Jung developed a model in which these factors interact to determine how a person relates to stimuli. This model was later adapted by Myers (1962) as a basis for the Myers-Briggs Type Indicator, a survey widely used to identify personality types and styles of interaction.

A number of researchers and educators have adapted Myers-Briggs work for educational purposes, in which personality indicators are used to determine ways in which individual can learn and process information. Silver and Hanson (1998) as cited in Silver, Strong and Perini (2000) used this to develop a model of learning styles (Silver, Strong, & Perini, 2000). They describe learning styles as being descriptors of the process of learning meaning; how an individual prefers to absorb information and their way of demonstrating their learning. According to this perspective a learning style is an active process of thought and expression of learning that occurs within the individual. Felder and Silverman from North Carolina State University developed the Felder-Silverman model to determine a persons` learning style(Felder & Spurlin, 2005). This model uses the Index of Learning Styles (ILS) an online learning style survey originally developed to gather data on the learning styles of engineering students in at a university level. The Felder- Silverman model which uses the terms "sensing" meaning a concrete thinker who is practically orientated, "intuitive" indicating an abstract thinker, "visual" or "verbal" learners, "active" or "reflective" learners and "sequential" learners who prefer work to be organized in a linear progression or global learners, who like to understand the bigger picture before breaking it into parts (Felder & Spurlin, 2005).

There are a number of surveys and tests to determine learning styles that use modes of sensory input to determine learning style. Many of these include three basic learning styles, "auditory learning", which occurs through processing of spoken input, "kinaesthetic learning" which occurs through active physical engagement and "visual learning" which occurs through looking at pictures, diagrams and watching people perform activities. In these models people who have more than one strong learning area

are described as "multi-modal". Paivio described a dual coding theory of learning in which the individual simultaneous processes two type of stimuli.

A range of other terms were found in the literature to describing learning styles for example activists, theorists, pragmatists, reflectors, verbalisers, imagers, analytics and wholists. There does not seem to be a common language to describe the different ways in which people learn. The Demos Report (2005) of the Learning Working Group commissioned by the ministry for school standards in the UK in 2004 reported that there are those who feel than there is not enough scientific evidence to support these theories of learning. The Demos report supports the idea of the establishment of a formal government funded commission on learning to investigate different approaches to learning and establish if they are based on valid research. This group also advised that a common set of terms must be selected so that teachers have a shared language to use when talking about learning (Demos, 2005). They suggested that teacher educators must be part of this initiative to promote this common understanding and make pre-service teachers aware of sound research based practices.

Multiple Intelligences was a term developed by Howard Gardiner to challenge the existing notion of intelligence being a single entity (Gardner, 2004). Gardiner attempted to widen the traditional notion of intelligence as being a single fixed entity to include a range of abilities related to the ability to solve real life problems, which are valued within one's culture. He defined intelligence as a psychobiological potential to solve problems or fashion products that are valued in one or more cultures (Gardner, 1999). Gardiner promotes a view of distributed cognition meaning that intelligence is more than the innate mental processes of the individual but extends to include the context in which the individual works and learns. This work was inspired by the work of Sternberg on culture and learning and Vygotskys` work on mediated learning. Gardner claims that his work is based on scientific research and observations of children over a twenty-five year period. In his book Frames of Mind (1999) he cites examples research undertaken by the Harvard Graduate School of Education in the Project for Human Potential in which educators and researchers investigate scientific evidence of strategies to enhance and support the development of human potential (Gardner, 1999).

This research led to the formulation of his theory of multiple intelligences. Gardner based this work on his vast experience in developmental psychology and his involvement in Project Zero based at Harvard University. Initially Gardiner listed seven types of intelligence but later added an eighth and possibly a ninth to the list. The

intelligences currently included are linguistic intelligence, logical-mathematical intelligence, spatial intelligence, musical intelligence, bodily-kinesthetic intelligence, interpersonal intelligence, naturalistic intelligence and existential intelligence. The dimensions of linguistic intelligence include those who prefer to use language either written, oral or auditory to learn and communicate. Logical-mathematical intelligence includes individuals who prefer to work with abstract symbols and figures. This intelligence is highly valued in conventional educational systems. Spatial intelligence can be described as those who use visual or spatial information to make meaning and communicate. Musical intelligence includes those who use musical, tone rhythm to process information and produce products. Bodily –kinesthetic intelligence describes those who use their body to learn and express their learning. Interpersonal intelligence includes those skills include the understanding of the feelings of other people and the ability to communicate well. Intra-personal intelligence describes the skills used in understanding one's self and working to personal strengths. Naturalistic intelligence includes people who are able to work with nature and animals. The most recent addition of existential intelligence describes those who have a knowledge and understanding of spiritual things (Kornhaber, Fieros, & Veenema, 2004). In the literature Gardner links the types of intelligence to people working in different professions for example a person with a naturalistic intelligence could work as a game ranger or an animal trainer.

Gardner recognizes that the list will change as society changes and different skills are valued. Multiple Intelligences (MI) help us understand the method or way of inputting material or learning content so that the individual can process it although Gardner did not promote this, these links are generally made by others based on Gardners` work. There are strong links between these applications of Gardners` work in schools and learning styles The critics of MI theory feel that the specific intelligences should be called talents because intelligence is more general term(Kornhaber, Fieros, & Veenema, 2004). Gardner acknowledges that MI theory is difficult to prove scientifically although it is based on scientific principles. In his book "Frames of Mind" he states that his intentions as " I wanted to broaden conceptions of intelligence to include not only the results of paper-and-pencil tests but also knowledge of the human brain and sensitivity to the diversity of human cultures." (Gardner, 2004. P.ix) He also warns against labeling an individual as having only one fixed intelligence but explains that while a person or group may prefer certain intelligences in one context this can change in different contexts.

There are descriptions in the literature of both good and bad examples of teachers using learning styles and multiple intelligences in classrooms. The best examples describe teachers who use this terminology to help students reflect on their learning and develop a metacognitive understanding of the way they learn(Felder & Silverman, 2002; Fogarty, 1997; Gardner, 1999, 2004; Hughes & Moore, 1997; Kornhaber, Fieros, & Veenema, 2004; Morgan, 1997). The worst examples describe teachers who treat learning styles as fixed entities and label students as having one particular style of learning, which can limit their progress (Demos, 2005). There are also examples of teachers who only teach in one specific style neglecting the development of other intelligences in the student. Gardner warns against the over simplification of MI theories leading to faulty assumptions and unsound use of this theory in schools (Gardner, 2004). There are descriptions in the literature of teachers who teach in a specific way, this can be referred to as their teaching style. Some research makes links between a teachers` learning style and their teaching style.

Although the Demos (2005) report states that there is little evidence that the use of these theories enhances learning in the classroom I found a number of research reports and literature reporting positive learning outcomes in classrooms where the theories of multiple intelligences have been used. Kornhaber, et al (2004) have written extensively about the results of using MI theories in a range of school settings in America and Canada with very positive results. When using these theories classrooms become very student centered. Felder and Silverman (2002) cite successful examples of using learning style theories in tertiary settings.

There appears to be support in the literature for the development of a common language to be used by teachers to describe different ways of learning. There was support for teachers using research to help students develop a metacognitive capacity to monitor, evaluate and control how they learn. The literature does caution educators from using educational strategies that are not based on scientific evidence.

2.1.10 Conclusions

The 1990`s have been called the decade of the brain (Fogarty, 1997). There has been so much development and increase in knowledge about how the brain functions. The use of PET scans and MRI imaging can tell researchers about the exact blood flow patterns to precise locations of the brain during tasks (Gazzangia, Ivry, & Mangun, 2002; Kellogg, 2003). It is now known how much energy is used when learning a new activity

and how that decreases when a task has been mastered. The research has shown that through repeated practice the neural networks in the brain can be changed and strengthened. This increase in knowledge on how brains function and how learning occurs in individual brains needs to be part of the knowledge base of teachers. If learning and thinking are the core business of educators they need to be aware of the latest developments on brain research and how this influences their teaching practice.

The previous ideas that intelligence was a fixed quotient has been outmoded (Sternberg & Ben-Zeev, 2001). The concepts of neural plasticity have major implications for educators (Fogarty, 1997; Gazzangia, Ivry, & Mangun, 2002). Teachers have the power to change the way in which a learner's brain processes information. The classroom environment can determine how much and how effectively a student learns. The way a teacher presents information can be adapted to suit the learning styles and brain preferences of learners (Kornhaber, Fieros, & Veenema, 2004). This will influence the neural connections in their brains, which can influence current and future learning.

The concept of learning as a social activity requiring an experienced adult or peer to mediate the learning experience has implication on how teachers plan group learning experiences and how they need to actively guide the learning of students (Baron & Sternberg, 1987; Worrall, 2002).

Current research is also showing the importance of knowing, understanding and controlling one's own cognitive processes. The work of Flavell on metacognition links executive control over cognitive functions with intelligence and success at cognitive tasks (Flavell, 1987; Livingston, 1997). This highlights the need for teachers to know and understand their own learning styles in order to have a deeper understanding of the concepts of brain compatible education and the need to create learning experiences to suit the learners in their classes. This also highlights the need for learners to have knowledge, and control of their own thinking and learning processes in order to maximize their learning potential (Buzan, 1995; Fogarty, 1997; Lozanov, 1995).

These new understandings have impacted on my own teaching in a tertiary context. I have adapted my teaching strategies and instructional strategies to accommodate the learning styles of my students. I have integrated new technologies to engage students in advanced seminars leading to higher levels of thinking when they debate, critique, analyse, question and challenge theories of education instead of the traditional lectures in which content is delivered. These changes to my own teaching practices will be described in chapters 4 and 5.

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2.2. Introduction to curriculum and learning

In all learning situations there needs to be a curriculum. The curriculum can be overt and mandated as in Western Australia or it could be an informal or hidden curriculum. The curriculum could be simply described as all the factors that guide and shape the learning experience. The topic of curriculum and the knowledge economy will be explored in the next section of the portfolio. This was selected because curriculum is an integral part of all teaching and learning. It is important that those involved in planning curriculum have an awareness of the hidden factors that impact on the curriculum; some of the political and economic factors impacting on curriculum in Western Australia will be discussed in the following section of the portfolio.

2.2.1 Curriculum and the knowledge economy

The work in this section of the portfolio developed from one of the core units EDU 7105 Curriculum in the Knowledge Society. In this unit we investigated various notions of curriculum, the hidden curriculum and underlying forces shaping the curriculum. This was relevant from me because I lecture in curriculum studies and have done much work in South Africa with the implementation of an outcomes based curriculum in the late 1990`s. It has been interesting to note the same top down implementation strategies being used in both countries with similar outcomes and responses from teachers. The topic I investigated was the current curriculum framework in Western Australia. I am particularly interested in the political influences on curriculum and areas of slippage between the ideology and the implementation of curriculum. These investigations resulted in the discussion paper included in section 2.2.2 of the portfolio

2.2.2 Curriculum in Western Australia

The research and work contained in this portfolio are written in a Western Australian context thus I have included a paper written critiquing the implementation of an outcomes-based curriculum in Western Australia. The political landscape in Australia with layers of governance at a federal and state level add a complexity to many issues particularly those surrounding education and funding. For many years there was a political conflict of power with the Liberal party being in power at a Federal level and the Labor party controlling the State Government in Western Australia.

At the time of writing, in 2008, there has been a change in government at a Federal level. The Liberal party has been replaced by the Labor party. This has led to a current feeling of flux among educators and parents of school going children in Western

Australia as many implanted policies and ideologies may change as a result of this political change. In Western Australia the Labor party continues to be in power at a state level, which may provide some sense of continuity in educational policy, yet there is talk at a federal level of the introduction of a new national curriculum. There is currently no indication what form this national curriculum will take. These tensions surrounding curriculum in Western Australia will be discussed in the following discussion paper.

2.2.3 Politics, pressure and curriculum in Western Australia

This is a discussion paper grew from work done in one of the units of the doctorate EDU7102: Learning in the Knowledge Society. It is evidence of the process of examining the hidden influences and pressures on curriculum, teachers and learning in Western Australia. In this portfolio I have chosen to include papers that I have written as individual publications thus keeping the format as presented in the original publication.

Politics, Pressure and Policy the impact on Curriculum in Western Australia.

Hargreaves (2003) states that teachers and others
...must think not only of how to teach for the knowledge society, but also of how to teach beyond it, so that we address other compelling human values and educational purposes in addition to those that make a profit – purposes concerned with character, community, democracy and cosmopolitan identity. We must think beyond state education providing value for money, to ensuring it also promotes values for good (Hargreaves, 2003).

Abstract

Perth, Western Australia is the site of a widely contested debate about a futuristic venture in curriculum. This paper uses the framework of Hargreaves' (2003) "Teaching in the knowledge society" in which he introduces the concepts of teaching for, beyond and despite the knowledge society. The paper discusses the implementation and the future of Curriculum Framework (Curriculum Council, 1998) in Western Australia and the degree to which this curriculum allows teachers to prepare learners for

the future. Slippage and power issues between state and federal structures are considered as major barriers to teaching for new futures.

Although discussion is limited to curriculum implementation in Western Australia, the critique and questions posed in this paper have relevance for all who are concerned by global changes and the challenges faced by educators wanting to prepare learners for uncertain future scenarios. The author acknowledges the complexities of the teaching-learning process and the many layers of discourse and slippage between conceptualisation of curriculum and the implementation in classrooms. The works of Quicke (1999), Young (1998) and Hargreaves (2003) will be used to support discussion on the conceptual underpinning of curricula for the future.

Introduction

The Curriculum Framework (Curriculum Council, 2005, p. p.43) an outcomes-based curriculum framework for Western Australian Schools is being phased in over five years and was mandated in all primary schools from 2004; it is still in the process of being introduced in secondary schools. This framework claims to be promoting deep thinking and social values, yet there are those who are concerned that it will not adequately prepare students to take their place in future societies. Its implementation has triggered much debate in the media and educational forums. This paper will discuss the following critical questions about the nature and implementation of this curriculum: What are the core concepts shaping the discourse of this curriculum? Why is the introduction of this curriculum surrounded by so much political tension? Will this curriculum allow teachers to prepare learners for future scenarios? Which factors are contributing towards slippage in the implementation of this curriculum? There has recently been a change in federal government in Australia with the Labor party that previously was in opposition taking over power. Although this has recently occurred already there are already shifts in policy and governance it will be interesting to see how this power shift will influence curriculum developments in Western Australia.

My interest in the politics of curriculum stems from over twenty-five years of involvement in education in Australia and South Africa. I have experienced in the implementation of an outcomes-based curriculum in South Africa am monitoring these curriculum changes in Australia. I lecture in Curriculum Studies at Edith Cowan University in Perth, which has the largest education faculty in Western Australia. This

is a philosophical paper based on a critical reading of the literature, official documentation and the media.

Two opposing viewpoints have emerged in the debate in the media surrounding the implementation of this curriculum: the democratic versus the technocratic perspective of education (Young, 1998). These viewpoints are used as a framework to evaluate the form, content and implementation of this curriculum. The Curriculum Framework (Curriculum Council, 2005) will be critiqued from the perspective of its ability to shape the curriculum for the future and to deliver social transformation. In other words, a curriculum leading to personal and social change.

Teaching for the knowledge society

It is currently acknowledged that we are part of the knowledge society. This term knowledge society was first referred to in Bell's (1976) seminal work *The coming of the post-industrial society*. Bell documented the change from an economy engaged in production to an economy based on services and the production of knowledge (Bell, 1976). There are various definitions of a knowledge society in the literature, such as societies that place high value on the processing of information to create wealth and economic growth (Burns, 2002b; Department of Education, 2005; Goldstein, 2004). Key features of knowledge societies are the reliance on the collective intelligence of the workers and their use of logic, analysis, deduction and linear thinking to promote economic growth and prosperity (Gazzaniga, Ivry, & Mangun, 2002). However, current literature is foreshadowing that we are soon to be moving beyond the knowledge society, and the most successful countries in the future will be those that can balance market pressures of global competition with sociological factors of equity, access, security and sustainability (Burns, 2002b; Hughes, 2004; Pink, 2005).

The knowledge society and beyond

Some scholars refer to the knowledge society as the age of the learning society. Learning societies can be described as societies engaged in promoting communities of learning. These learning communities are not confined to the years enrolled in the formal education sector, but recognise that learning takes many forms and can occur in a range of settings spanning a lifetime (Hargreaves, 2003; Quicke, 1999; Young, 1998).

A factor characterising the knowledge society is the rapid growth in knowledge. Quicke (1999, p.11) challenges our traditional discourse on learning, knowledge acquisition and transfer: "From an epistemological viewpoint, there have been changes in the way we typically understand the nature of knowledge and what it means to know." Research in cognitive science has changed the way we think about learning and development (Gazzangia, Ivry, & Mangun, 2002). For example, applications of f-mri scanning reveal new information on how the brain reacts to learning events. The concept of neural plasticity has led to the understanding that by providing the correct learning environment and learning experiences at the critical point in a learners` brain development, we can influence their neural development and functioning (Abrahamsen, Graham, & Bechtel, 1998; Dobbs, 2005; Fogarty, 1997; Gardner, 2004; Gazzangia, Ivry, & Mangun, 2002).

This research has far-reaching implications for educators and curriculum developers. It implies that we need to provide the correct learning experiences for individual learners when they are at the optimum point of neurological readiness (Abrahamsen, Graham, & Bechtel, 1998). The research validates the importance of the learning environment and the crucial role played by the educator who customises the curriculum to suit the learning needs of the students (Gazzangia, Ivry, & Mangun, 2002; Guenther, 1998b). This research supports the educational significance of a flexible curriculum, so that teachers can use their professional expertise to customise the curriculum to meet the learning needs of their students.

Research in cognitive psychology has revealed new perspectives on how we conceptualise and nurture intelligence. For example, the findings of Project Zero conducted by Gardner (1999, 2004) and colleagues at Harvard University reveals insights about a broader conceptualisation of intelligence encompassing a range of preferred learning modalities and preferred ways of expressing learning. Gardner's work has been used in numerous educational settings with enhanced learning outcomes for students (Fogarty, 1997; Gardner, 1999, 2004). This view is supported by Hargreaves, who states, "new approaches to learning necessitates new approaches to teaching"(Hargreaves 2003. p.16.). These research outcomes indicate that we need to be teaching in new ways to prepare the current generation of learners for new times. We need to be focussing on the thinking learning process and promoting the metacognitive skills of learners. This broader perspective takes learning out of the traditional content-based, teach, test, evaluate paradigm. It has implications for educators that will be

discussed further in the section critiquing the Curriculum Framework in Western Australia (Curriculum Council, 2005).

Intriguingly, globalisation and technological advances have both shaped and limited the growth of knowledge societies. When trying to predict future patterns of economic growth and development, we need to be aware that knowledge alone will not be sufficient to sustain growth. A limitation of the growth of knowledge societies is ironically coming about through the technological developments of connected global networks and widespread usage of Internet Protocols that are shading the growth of knowledge-based societies by making knowledge readily available to all. This means that the domain of possessing information is no longer a privilege reserved for the elite or educated classes and thus the possession of information will no longer guarantee market share or economic success. This implies that we need to work beyond the knowledge paradigm.

Current research on economics reveals the that just as emerging market economies were able to out produce and under-price Western manufacturers in the Post-Fordist Era, those same markets will soon be able to perform knowledge-based activity more competitively than the established markets (Goldstein, 2004; Hargreaves, 2003). The advances in technologies will both limit and shape the growth of knowledge societies, because many of the occupations based on the processing of information and knowledge will become obsolete or undervalued because these activities need linear processing, which can be performed more economically and efficiently by microprocessors.

In a globalised economy, where those who can perform the task for the lowest price invariably get the job despite their global location, Westernised economies will need to redefine their market share to remain economically viable. To cite Quicke (1999,p.14)

All countries need to recognise that since the essential ingredient in economic success is knowledge and applied intelligence, education and training systems will have to focus on the production of knowledge workers, those who have the appropriate high-technology skills for wealth creation in the information society.

This viewpoint described by Quicke and Hargreaves, is based on a technocratic model where economic prosperity is linked to the creation of skills in certain community members (Hargreaves, 2003; Quicke, 1999; World-Bank, 2002b; Young, 1998). There are others who disagree with the technocratic viewpoint feeling that education should be

viewed from a democratic perspective. This democratic perspective promotes a values-based curriculum that aims to develop well-rounded individual citizens (Department of Education, 2005). The implications of democratic and technocratic perspectives on education will be discussed further below.

Teaching for the future

The concern in this paper is whether the Curriculum Framework being implemented in Western Australia is supporting teachers to prepare learners for what lies beyond the knowledge society. On the one hand, there is much debate and supposition in the literature about what the future will hold. Pink (2005) has described a future society in which knowledge production work has been outsourced or can be performed by computers, but where the skills most highly valued are those of innovation and creativity. "We need to be preparing our students to think beyond the square, not replicate knowledge but to add value, to reconceptualize to create new innovative solutions to sustain our future on this planet" (Pink 2005, p.52). This supports Hargreaves` more democratic perspective of teaching: to think past education promoting economic profit towards the development of human potential. Hargreaves, highlights personal development of "character, community, democracy and cosmopolitan identity" (2003, p.43) as being of most value in a future society.

Some sociologists are predicting that a new era, the conceptual age, will dawn (Hughes, 2004; Pink, 2005). In this era individuals will be required to think and work in new ways. This type of thinking will require more than just a knowledge component. The knowledge component of thinking can be described as a logical, analytical, language-based activity predominantly utilising areas in the left cerebral hemisphere. However, it is claimed this type of thinking will not be enough to sustain and develop our place in the global economic society (Bellugi, 1993; Johnson, 1993). According Gardner (2004) and other researchers in the field of creativity and learning, more creative, holistic thinking that predominantly occurs in the right cerebral hemisphere of the brain will be highly valued in the future (Fogarty, 1997; Gardner, 2004; Gazzangia, Ivry, & Mangun, 2002). This literature predicts that innovative creative thinking, which currently cannot be replicated by machines, will be needed for a society to remain economically competitive and environmentally sustainable in the future. Key competencies that will be needed are creativity, innovation, flexible thinking, collective intelligence, emotional intelligence and self-knowledge (Gardner, 2004; Goldstein,

2004; Hargreaves, 2003; Hughes, 2004; D. H. Pink, 2005). This will enable people to design new products to capture the market share and to think creatively and sustainably about environmental and global issues to ensure our survival on the planet. Thus flexibility and innovation will be key skills needed in the future and workers will need to be constantly upgrading their skills to cope with new technologies and job demands (Burns, 2002b). Moreover, citizens of the future could possibly be working in industries or areas that currently do not exist.

This poses many challenges for educators. How do we prepare learners for a future that can be so different from our present reality? What are the core competencies that they will need? In the light of this futurist scenario, to fill learners` heads with more knowledge, which may become obsolete as fast as it is learnt, or with more information that can be downloaded from the Internet, is a useless exercise. "Our thinking has to take account of many aspects of a complex world, one which is changing so rapidly that the questions about 'what to teach' are obsolete almost as soon as they have been asked " (Quicke, 1999). The following section of this paper will discuss the introduction of a new curriculum framework in Western Australia and debate whether this curriculum allows teachers to teach for, despite and ultimately beyond the knowledge society.

Current understandings about curriculum

In setting the context for discussion about the implementation of this specific curriculum, it seems appropriate to examine definitions of curriculum found in the literature. In reviewing a range of sources, it becomes evident that a context of global, economic and political change permeates all our thinking about curriculum. One of the core concepts underpinning educational practice is how we view curriculum. Grundy (1987) discussed curriculum first from a positivistic stance. In this view curriculum is considered as a product with knowledge as a fixed entity (Grundy, 1987). Educators holding this positivist view of curriculum will emphasis the teaching of facts. This type of curriculum will tend to be teacher-centred and will include norm-referenced, standardised assessment practices. A curriculum stemming from a positivistic perspective will value the transmission of content and assessment processes will be designed to measure the direct correlation between learning and the recall of facts. Thus, measures of accountability are implemented to see whether education is delivering value for money. When looking at current criticism of curriculum change in

Western Australia, there is evidence of a federal conservative initiative to impose this positivist view with an emphasis on economic rationalisation and accountability.

Another perspective on curriculum is to view the curriculum as practice (Grundy, 1987). In this perspective, learning is the core focus of curriculum. The emphasis then would be on the process of making meaning and understanding, not on reproducing knowledge. Young (1998) criticises this view of curriculum as practice as he feels too much focus is on the teachers and the students and a range of external factors are overlooked (Young, 1998). The Curriculum Framework in Western Australia contains strong elements of curriculum as practice as there is an emphasis on the process of learning via the outcomes-based approach.

Curriculum can also be described as praxis. Grundy refers to this as a form of social transformation (Grundy, 1987). Engagement in this form of curriculum is considered to lead to personal and social change. An exemplar of curriculum for transformation was the work of the Brazilian Educator Paulo Freire. Freire saw curriculum as a dialogue between the student and the teacher, working together to create deep meaning, leading to community building and social change. Freire criticised the positivistic view of curriculum as " Banking education," with the educator making deposits of knowledge in the minds of the students (Freire, 1972, p. p.43). Freire challenged educators to "transform transfers of information into a real act of knowing"(Freire, 1972). Although Freire made these statements in a different political climate and context over thirty years ago, his idea of curriculum as praxis promoting deep learning is echoed in the Curriculum Framework in Western Australia (Department of Education, 2005).

Quicke (1999) discusses the concept of a democratic curriculum, supporting the ideal that learning is the right of all citizens and opposing the notion of stratification of knowledge that restricts access to certain types of learning to an elite group (Quicke, 1999). The Curriculum Framework in Western Australia promotes inclusivity and accommodates learning diversity through the flexible levels of learning and the seamless approach from K-12 (Education Department, 1998). Through examining the viewpoints of Quicke, Freire, Grundy and Young, the reader can see that curriculum is a highly politicised construct that has different meanings to different interest groups. The enactment of curriculum is politically very powerful as it controls the shape and future of that educational setting and has a profound influence over the learning and thinking of that generation of learners. The Curriculum Framework in Western Australia will be further critiqued to see which perspectives on curriculum shape the discourse.

The core concepts shaping the discourse

The Curriculum Framework in Western Australia is an outcomes-based framework for learning, in which the focus has shifted from content to outcomes. Outcomes can be described, as the learning students will be able to demonstrate as a result of a learning experience. Thus the emphasis has shifted from what is taught, to what students learn. This is a huge paradigm shift implying a change from a teacher-centred approach to a student-centred approach in teaching and learning and with a focus on the processes of thinking and learning and the establishment of values. The aim is to develop the innate potential learning skills of each individual learner and to provide them with the tools to become lifelong learners (Curriculum Council, 2005). This is in contrast to contents-based models in which curriculum is largely focussed on the inputs or contents to be taught. The contents-based models of curriculum are generally more in line with a positivist perspective on education, as discussed previously in this paper. Content-based models of curriculum will rely on prescriptive syllabi, which will control the content taught by teachers. The content-based models are often premised on a behaviouristic style of pedagogy in which learning is linked to extrinsic rewards and grades for mastering specific content.

The Curriculum Framework (Department of Education, 2005) is based on a constructivist epistemology in which individual learners construct their own knowledge base though demonstrating the attainment of specific outcomes. In the initial documentation, it is stated that this is not a curriculum but a framework indicating learning outcomes. The intention of the framework is not to prescribe content but to allow educators to select the educational experiences for their learners that will best enable them to achieve the outcomes (Curriculum Council, 1998). This perspective is aligned with Grundy's (1987) and Freire`s (1972) views of curriculum as praxis where the teacher and the students have the flexibility to select and create the learning experiences that are relevant to the learner and will guide the learner to achieving the desired outcomes. This approach allows teachers the flexibility to keep up with the rates of change in society and customise the learning experiences to maximise authenticity and promote real, deep learning.

The outcomes-based approach is also reflective of democratic principles, where knowledge is not stratified or restricted to certain groups. The Curriculum Framework has a seamless approach to learning from K-12 where learners work through levels of learning at their own pace. The levels are not clearly divided into years or class

structures. This curriculum framework acknowledges that learners learn at different rates, in different ways, in different learning areas, and provision is made for learners to progress through the levels at a rate suitable for their own learning potential. This differs from the traditional content-based syllabus where all learners need to master the same material at the same level of difficulty. The outcomes-based approach is designed to allow learners who are more or less advanced to work on outcomes and levels suitable for their level of understanding and engagement. It also makes provision for those learners who have barriers to learning to work on outcomes that are appropriate yet still able to participate in the learning experiences with their peers. This would fit the criteria that Quicke (1999) detailed when discussing a democratic curriculum for all. The position statements included in the introduction to the Curriculum Framework (Department of Education, 2005) clearly indicates a commitment to progressive teaching for and beyond the knowledge society. However, as will be seen in the discussion to follow, such an approach is being criticised from many quarters.

The implementation of the Curriculum Framework in Western Australian Schools.

The Curriculum Framework was phased in over a four-year period. The implementation started in the lower grades and has progressively worked its way up through to secondary school. There have been varied amounts of training for teachers as the project has progressed. There has been widespread consultation of teachers in the development of the curriculum framework. Focus groups were held with teachers during the first phase of implementation, known as Curriculum Improvement Program 1 (CIP-1). All Primary schools are now in Curriculum Improvement Program 2 (CIP-2). In CIP-2 certain parts of the curriculum framework were redrafted in response to teachers` responses and pressure from federal government. A new reporting and assessment policy "Curriculum, Assessment and Reporting K-10: Policy and Guidelines" (Department of Education and Training, 2005) has replaced the previous policy on assessment released in 1998. New features in the revised policy are standards known as achievement targets, which are minimum standards of achievement in years 3,5,7,9. The implementation of this policy has been mandated from 2005. These changes already represent slippage from the original assessment policy in which students were assessed according to levels of achievement, that were more flexible and responsive to the individual learning needs of the students. An integral part of the new

assessment policy is the incorporation of norm-referenced standardised data from tests originating from a central source in another state. The Western Australian Branch of Australian Educators Union opposes these changes (Kelly, 2005). The basis for their opposition will be discussed later in this paper.

A brief overview of educational provision in Australia

In order to contextualise educational provision in the state of Western Australia it is necessary to give a brief overview of provision across the country. Australia is a vast country, which consists of a number of states that are self-governing in some respects. Australia is a democracy. The two largest political parties are the Liberal Party and the Labour Party. There is a Federal Minister of Education who is a member of the ruling party. Each state has elected a Minister of Education. In the Australian political context a liberal-coalition held power for two terms and has recently been replaced by a labour government. At a state level and in the case of Western Australia, the Labour Party is now in its third term of office. Under the previous government before November 2007 there were opposing political parties in power with the liberal coalition in federal government and the labour party in power in the state government in Western Australia. This situation created a number of political tensions, which will be discussed further in this paper.

The funding for education is complex and beyond the scope of this paper, yet it is important to mention funding for primary and secondary education comes from primarily from the state, but certain significant portions of funding come from federal sources. These latter funds are increasingly granted subject to certain restrictions or policy impositions from the Federal Government. In theory, each state has autonomy over the school curriculum yet in practice there are increasing pressures from the federal government to withhold funds if certain of conditions are not met.

Why is the introduction of this curriculum fraught with so much political tension?

At this point is would be appropriate to consider the social and political contexts. As curriculum is such a highly politicised arena, hierarchies of power need to be considered. In the words of Hargreaves in order to teach for and beyond the knowledge society "one requires strategies that empower rather than constrain" (Hargreaves 2003, p.1.) However, in the case of curriculum implementation in Western Australia the

political hierarchies appear to be constraining and undermining reform rather than empowering innovation. The previous Federal Minister of education was constantly in the press criticising the state education initiatives. The pervious Federal Minister of Education, Brendan Nelson under the liberal coalition clearly promoted norm-referenced testing, following a move towards standardisation reminiscent of the current trends in America. These policies of standardisation and accountability in America and England have resulted in the development of league tables and standardised assessment procedures. The education journals and the media contain many examples of the negative effects of these policies on the morale, effectiveness and levels of innovation of many teachers operating in these systems (Maiden, 2005; Menzes, 2005; D. Penney, 2004 (b); Rowe, 2005).

The core principles of inclusivity would be impossible to implement where all learners are being assessed on the same standardised tests. This removes the flexibility from the curriculum framework as teachers will need to work towards a more content-based approach in order to meet the learning targets set in the achievement targets for certain grades. The new assessment policy mandates that reports contain grades and quartile rankings, which include the use of norm-referenced standardised test results for each child. This is in direct opposition to the system of levelling and the use of outcomes as presented in the original curriculum documentation. Teachers will be tempted to turn back to teaching content, focussing on improving test performance instead of the process orientated deep learning work towards the outcomes in the curriculum framework.

Recently the Australian Education Union has publicly rejected the changes to the assessment and reporting policy. In a large notice in a local newspaper to parents and teachers, the State School Teachers` Union has directed all members not to implement the new reports. They list the following objections

"Because the Federal Minister has forced on WA schools a report which requires:

Teachers to report on your child's progress in two incompatible ways

Teachers to rank and grade each student, a process that is superficial, provides no educational value for your child but provides figures for political purposes. (Kelly, 2005).

Public threats were made by the then Liberal Federal Government to withhold large amounts of funding if certain reporting procedures are not undertaken. The dilemma for Western Australian educators was that these procedures were ideologically

opposed to the nature of the current curriculum framework. The Curriculum framework advocates students working according to their learning needs through a flexible system of levels. Yet the previous federal minister of education (Dr Nelson) was advocating a series of standardised tests, with grades and quartiles to be made publicly available for the sake of accountability. Another federal initiative is the introduction of league tables in which schools across the nation would be compared according to results obtained in the final year twelve examinations. Garth Wynne, the principal of a highly rated, independent school in Perth, publically critiqued the introduction of league tables saying that the league tables should be made illegal. "Such tables are, which have unfortunately already led to public money being misdirected, are shallow and unhelpful and add nothing to the quality of educational outcomes for the students of WA" (Wynne, 2005). Wynne`s viewpoint, surprisingly, is in line with the long-term educational benefits of the contested curriculum framework. As Wynne points out, the previous Federal Government's imposed changes to the assessment policy challenged the core ideologies of the WA curriculum.

There is much speculation as to why this occurred but there is little doubt that these tensions have created much uncertainty in the minds of teachers and parents. One view is that an educational crisis was being manufactured by the previous government to undermine public confidence in education in Labor run states and to promote ambitious political aims of establishing a national curriculum (Reid, 1999, 2005). Arguably the initiatives proposed by the former federal minister of education in promoting a technocratic approach, with a return to content-based curricula, (a one size fits all curriculum), standardised testing and a wealth of accountability measures, undermined the professional status of teachers. Regardless of the motivation, it would seem these initiatives were not preparing learners for the future but blocking educational innovation.

Teaching despite the knowledge society

There are aspects of the knowledge society that can hinder educational progress and block deep learning occurring. The factors that can negatively affect education are the concepts of global competition, accountability and economic rationalisation components of a technocratic view of education. Economic rationalisation led to the thinking on education providing value for money rather than being seen as a social service, which is an investment in our children's` futures. This seems to be the

perspective taken by the former federal education minister, which is in contrast to Hargreaves` perspective to "think beyond state education providing value for money, to ensuring it also promotes values for good" (Hargreaves, 2003). It is in this context that we need to be aware of slippage between policy and implementation (D. Penney, Evans, J., 1999; Young, 1998). This is a major factor to consider when new curricula are introduced. Initially there are large paradigm shifts in thinking yet after implementation there is a tendency for these changes to slip back into old familiar patterns. The result of this is that the new curriculum becomes a watered-down version and many old practices are reintroduced, thus diluting the effectiveness of the new practices.

Thus with the state bowing to the previous federal ministers demands, many of the brave initiatives taking this curriculum beyond the knowledge society were diluted or neutralised by the reintroduction of technocratic practices (Reid, 2005). For example, inclusivity, one of the core principles of this new WA Curriculum Framework, was at risk when all learners are compelled to do common standardised assessments. These standardised, norm-based assessments whose results have to be included in reporting documentation will do little for the self-esteem or educational progress of the most vulnerable learners. Many of the standardised assessments monitor achievement narrowly through written tests; this method of assessment will disadvantage those learners for whom written testing is an area of weakness. The fact that these test results need to be made public on report cards and arranged in quartiles will humiliate those learners 'at risk'. The intention of the WA curriculum is to develop the strengths in learners and allow them to progress at their own rate, yet these assessment policies are propagating 'a one size fits all policy' in which all learners in the same grade need to be assessed on a common assessment. By contrast, the WA Curriculum Framework advocates a system of levelling and criterion-referenced assessment, which is in alignment with the core philosophy of individualising the curriculum and allowing each student to maximise their full potential.

These standardised assessments are subject bound, impressing the rigidity of traditional content domains. The values being inculcated in "teaching beyond the knowledge society" would be over-ruled when these content-based assessments are given so much emphasis. The changes in the assessment policy seems to be a major area of slippage back to old outdated practices, which are not supportive of a progressive curriculum.

Additional areas for slippage

Another potential area for slippage is in the implementation of the curriculum in the classroom. The author has conducted a small-scale research project with educators to gather data on their professional development needs to implement the curriculum framework. The study reveals that although the teachers had received a significant amount of high quality professional development, they indicated a need for more specific development in the areas of how to promote the thinking and learning processes embedded in the new curriculum. Teachers also indicated a need for further training on how to individualise the curriculum, that is, how to cater for the individual learning styles of learners. The majority of teachers surveyed indicated that they did not receive sufficient training on how to teach students about their own learning and thinking processes during their pre-service teacher education.

These teachers also indicated that they had limited understanding of their own learning and thinking processes. The question needs to be asked: how can teachers be expected to effectively teach a curriculum based on deep thinking, when they have received limited training in this area and have little understanding of their own thinking processes? The learning of deep thinking is a complex process. It does not just happen incidentally while content is being transmitted. There are a range of explicit programmes to encourage the development of thinking skills, for example "Instrumental Enrichment" (Feuerstein & Hoffman, 1982). Given that the average age of teachers in Western Australia is over 45 years old, it is fair to assume that during their pre-service teacher training many of these teachers did not receive training in the current constructivist principles of education, which underpin the WA curriculum framework. Hence, the lack of adequate professional development for in-service teachers can be a big barrier to the implementation of this curriculum.

Conclusion

After analysing the WA Curriculum Framework it could be argued that this isolated state has been setting a brave course with a vision of teaching for the future. Yet there are many powerful political forces attempting to block this initiative. We have recently had a change in government in the federal election in Australia. The Labor party is now in power; it will be interesting to observe the continued implementation of this curriculum to see whether the state education leaders have the commitment to stay their

course, or if they will be swayed by new initiatives for a national curriculum from the federal ministry of education.

Already there have been major incidents of slippage regarding the assessment and reporting policy, which betray the core ideologies of outcomes-based education. It is vital that a common understanding is developed between all stakeholders on a national and state policy level. There is currently much confusion among teachers and parents in Western Australia will the new leaders continue along the contested outcomes path or will there by yet another change in curriculum? Whatever path is selected, education leaders will need to learn from the mistakes made in the implementation of this curriculum and make very clear the processes vital to the successful implementation of any new curriculum. This includes making explicit the teaching processes imbedded in the curriculum to all stakeholders. If any changes are made care needs to be taken as teachers in the state are currently feeling "very fragile" as a results of so many changes in curriculum over the past few years. There are currently large issues embedded in the curriculum that after a number of years of implementation are still problematic from many teachers, for example assessment, how to cater for the individual learning styles of students and how to include students with diverse learning needs. These topics need to be included in pre-service teacher education and in-service professional development courses for all teachers. Furthermore curriculum developers need to speak in a language free of academic jargon to communicate key concepts to all stakeholders.

State Education authorities need to use a professional media campaign to repair the damage caused by the attacks from outside sources, and to promote public confidence and acceptance of any new curriculum changes. Above all, whatever new initiatives are selected educational leaders need to remain committed to educational reforms and focus on teaching beyond the knowledge society to prepare citizens for the challenges of conceptual age of the future.

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The work done on curriculum led to me to reflect on the curriculum in courses I teach for pre-service teachers. I became aware that I needed to update this curriculum in order to make it relevant for teachers of the future. I embarked on a research project with teachers to find out what professional learning they felt they needed to keep their teaching appropriate and relevant for today's learners. This work with teachers is described in phase 1 of the research it formed the basis for the reconceptualisation of the curriculum in the courses I teach for pre-service teachers. The work with pre-service teachers will be described in phase 2 and 3 of the research.

CHAPTER 3

Research Projects

Ch 1 Introduction	Ch 2 Lit review	Ch 3 Research Phase1 Teachers	Ch 4 Research Phase 2 Preservice Teachers	Ch 4 Research Phase 3 Post Grad Students	Ch 4 Research Phase 4 Technology in teaching	Ch 5 Future of Teacher Education	Ch 6 Conclusion

Figure 7: Portfolio progress map chapter 3

In the doctoral program we were encouraged to engage in a series of investigations linked to the theoretical units of coursework. In the section below I will describe the project I initiated for phase 1 of the research. This first project could be seen as a preliminary study, which set the context for the later phases of the research. This links to a unit of coursework entitled EDU7101 Methods of Investigation. In this unit we planned a research project, developed a research proposal and made application to the university ethics committee for permission to do the research. Finally the research proposal was presented to a group of academics and peers who reviewed and critiqued the proposal. After the review of the proposal further work was done taking into account the comments of the reviewers before the completed proposal was submitted for approval. I will now describe the first investigation in which research was undertaken with teachers to gather data on their understandings of current learning theories and their needs for professional learning in this area.

3.1 Phase 1- Teachers

This project was undertaken with teachers and educators to determine if there was a need for professional learning on the topic of learning styles and learning research to help them deliver the new curriculum in Western Australia. This linked to the work done on curriculum in the previous section of the portfolio as I had been asked to engage in curriculum planning for the courses that I teach to pre-service teachers. My plan was to first speak to teachers to gather data from them on what areas they felt had not been adequately covered in their pre-service teacher education. I also wanted to find out from teachers what professional knowledge they regarded as making an important contribution to their teaching in the classroom. I selected the topic of learning style theories and research on brain development and the implications for teachers. I selected these topics for investigation because they were important components of the

Curriculum Framework, the mandated curriculum in Western Australia for example in the curriculum guide for English in each strand, the strands being different areas, an emphasis has been placed on metacognitive processes and strategies. As stated on p.7 of the Curriculum Guide for English ((Curriculum Council, 1998).

Metacognitive processes and strategies

Content for metacognitive processes and strategies are described in each phase of development. Metacognition refers to the knowledge people have about their own thought processes. Learning may be enhanced by teaching metacognitive skills in organising, monitoring, evaluating and regulating one's thinking. Students should be taught the vocabulary to talk about their own learning and thinking processes; knowledge about learning and thinking strategies, such as when and why to use them and the extent of their effectiveness; and knowledge of self, such as awareness of one's preferred approaches.

As can be seen in the quotation above teachers in the English Language area of study are expected to be able to work with learners giving them the language to express conceptual understandings about their own learning. This is part of the mandated curriculum in Western Australia and is a different approach to the content-based approach in which teachers have been trained in the past. According to this curriculum teachers need to have knowledge about individual thought process, knowledge of metacognitive skills and strategies, knowledge of their own learning and their preferred approaches to learning. This type of deep reflective work on learning and cognition is found in many of the documents connected to the Curriculum Framework in Western Australia. This is why I felt it was important to see what teachers` understandings of these constructs were and to use these current teachers views when planning new curricula for future teachers.

3.2 Ethics

The faculty of education and the arts ethics committee granted ethical clearance for this research. Strict ethical criteria were followed for all the research activities in this portfolio.

3.3 Epistemology

The epistemology that informs the theoretical perspective on which the proposed research is based is constructionism (Burns, 2000). This view claims that people are actively involved in constructing meaning while they are engaging in their environment and their work. In the context of the problem to be researched, this epistemological perspective underlies research actions, which is to construct understanding and derive new knowledge of teaching strategies for students with diverse learning styles through classroom practice and research. The school, the classroom, the students and professional partnerships with teachers constitute the environment. The teachers and students need to work together to create a shared understanding of the situation (Burns, 2000).

Given the nature of the problem to be researched, the constructionist view is best suited to investigate the application of these concepts, how the teacher's metacognition of their own learning styles and needs filters their instructional decisions in the classroom. It must also be noted that while the constructionist approach is generally associated with qualitative methods Burns ((DfEE)) suggests that mixed methods can also be used in this research.

3.3.1 Methodology

In this research a combination of qualitative and quantitative methods have been used. Quantitative methods were used to report data on teacher's knowledge of their own learning styles and learning theory, their previous training and their needs for future professional development. Descriptive statistics were used to report areas of need for professional development.

Qualitative approaches were used when the researcher wanted to gain an understanding of the thoughts and feelings of the participants in the study to determine their metacognitive awareness of their own learning styles. Consequently participants were interviewed to gather rich data on their own feelings and perceptions and beliefs of their learning and learning theory. The questionnaires also included some open-ended questions to gather qualitative data to add richness to the research.

3.3.2 Questionnaires

A questionnaire is an effective method of gathering data from a large and dispersed group of participants. In this study a descriptive questionnaire was used. This type of questionnaire aimed to gather data from a group of teachers on their prior knowledge, beliefs and future professional development needs regarding learning theories and current research in cognitive psychology. The questionnaires used can be described as a one shot questionnaire (Dyer, 1999). Data was collected from a sample drawn from the population of interest, primary, secondary and early-childhood educators in a district in Perth, Western Australia.

The questionnaires were carefully developed and a number of versions were tested by a group of experts, academics and school leaders before a final version was selected for a pilot study. In the pilot study a group of six educators examined the questions and the wording for clarity and accuracy. The feedback from this group was used to modify the questionnaire before they were used, for example a number of questions were reworded to simplify the meaning. The ethics committee of the faculty also examined the questionnaires before they were distributed.

The questionnaire contained twenty-two questions. The first page gathered background data for example age, gender, teaching qualifications, where they undertook their teacher training and the number of years teaching experience they currently had completed. Participants were also asked to indicate if they have attended professional development on current research in learning theories and brain development and if so when this took place. These background or demographic questions were important to set the context for the research and indicated if the participant had a need for professional development in this area.

The next set of six questions use a Likert scale of strongly agree, agree, neither agree or disagree, disagree and strongly disagree and participants had to tick the box to indicate their choice. The follow six questions gathered data on the participants past learning experiences at school and during their teacher training. Two open -ended questions gather qualitative data on the participants` own learning style and how they thought learn best.

Questions seven to sixteen gathered data using a Likert scale on the participants current understandings about learning. Questions seventeen to twenty-two gathered data using a Likert scale, on the participants need for professional development in the areas

of integrating learning style theories into their classroom teaching. The questions were written in clear language, which was easy to understand, for example question twenty – two:

I would like more information on how to use multiple assessment methods to suit the learning needs and styles of the learners.

The questionnaire used can be seen in the appendices

3.3.3 Interviews

Interviews can provide rich sources of data. The personal qualitative nature of the data collected can add richness to the research. In this research a series of individual interviews were conducted with teachers. The interviews were tape-recorded and transcribed verbatim for analysis. The information was analysed using conceptual coding according to a set of pre-determined categories. The categories were identified before the interview process started but remained open to new categories arising from the data. This added validity to the study (Dyer, 1999). The interviews were semi-structured which allowed the research to guide the individual interviews to gather case specific data, this added richness to the study. The researcher had an outline of the interview questions but had the freedom to rephrase questions if they were not understood or if the answers were too broad. Data was organised into themes. An advantage of using interviews is that very specific data can be collected (Hopkins, 2002). A disadvantage of interviews is that they are time consuming. For this research only a few interviews were conducted to add validity to the data collected from the surveys. Participants for the interviews were recruited by attaching a letter to the questionnaire. The selection resulted in teachers from a range of schools being interviewed.

3.3.4 Data analysis

The data from the questionnaires was analyzed in two ways. Many of the questions were based on a five point Likert scale. The Likert procedure is commonly used when gathering data on people`s attitudes (Dyer, 1999). Teachers indicated if they strongly agree, agree, neither agree or disagree, disagree or strongly disagree. This quantitative data was analyzed using SPSS computer software to see trends in the ways teachers think about learning and how their past experience and attitudes influence instructional

decisions. In the analysis descriptive statistics, frequencies and medians were used to describe general trends with in the groups. Groups were slit into sub-groups so that frequencies could be compared to see differences between groups. Bar graphs were used to graphically illustrate the trends in the data.

The questionnaire also contained open-ended questions, which were analyzed from a qualitative perspective. These were placed into categories using key words and statements to gather rich data on teacher's attitudes, thoughts and feelings about their own learning, their selection of instructional strategies and their needs for future professional development.

3.3.5 Limitations of the study

The limitations of this research are that this is a small project involving only a small percentage of teachers in one school district. This means the results will not necessarily be generalisable to the whole population of teachers in Western Australia or the broader society. However this is the district in which the researcher works and it will be meaningful to have data on the needs of teachers in this district. This study could be replicated in other districts or on a wider scale if further data is required. Another limitation is that the subject of learning and thinking is a vast one and in such a modest project one can only investigate one small aspect of this topic.

3.3.6 Significance of the research

We are currently in a position in many countries where teacher education courses are being seen as in need of reconceptualisation to meet the challenges of the future. This need for change was very evident at Asia Pacific Deans` of Education Forum held at Edith Cowan University in February 2008. At this forum educational leaders from across the region discussed challenges and limitations in the currently models of teacher education offered in their countries. Many of the participants expressed the need the development of a curriculum for teacher education which moves beyond the transmission of content to personal development of flexible thinking, creativity, higher order thinking and learning skills thus preparing teachers to meet the challenges of working in a globalised digital society.

The significance of this study will be to meet the needs of teachers who are faced with diverse groups of learners in their classes. The approach of using students

learning styles and needs as a way to plan and teach whole classes while accommodating the individual needs of learners is current and relevant for teachers. The study can promote a metacognitive awareness of individuals learning processes in both teachers and their students. The professional development materials that may be developed as a result of this study can assist teachers to be aware of their own learning needs, styles, beliefs and current research in the field of cognition and learning theory.

3.3.7 Reliability and validity of the research

Data was collected using more than one data collection method. This technique is called triangulation and is used to improve the internal reliability of the study (Burns, 2000). Reliance on one method could lead to bias and distortion. The initial impressions were tested through the use of mixed methods to collect data. The methods contrasted with each other, for example a survey and interviews. The different methods used produced different sets of data. Triangulation thus contributes to the reliability and validation of qualitative analysis by checking the accuracy of findings generated by different data-collection methods (Burns, 2000). Both qualitative and quantitative methods were used to add authenticity to the study. In order to achieve a high level of reliability of the data collection instruments, expert feedback and judgement was obtained on the development of the data collection instruments.

3.4 The conceptual model for the research

In figure 8 a conceptual model for the research has been developed in the form of a series of radiating circles. The outer layer or largest circle deals with metacognition, the individuals understanding of their own thinking and learning process. This is the overarching belief of the researcher that the teacher needs to have an inner knowledge and understanding of their own learning, leading to an understanding of how others learn. In the conceptual model the second circle illustrates how that understanding about learning is made up of a number of equally important components; a belief about yourself as a learner, knowledge about the learners you are teaching, your prior experiences of learning and a knowledge of current research and practice in this area. These factors can influence the instructional decisions made by teachers. These layers of metacognition, impact on instructional decisions made by teachers and can influence the way they teacher diverse classes.

In the research phase 1 the researcher set out to investigate teachers understandings of these concepts and to find out if teachers need professional development to help them develop these understandings.

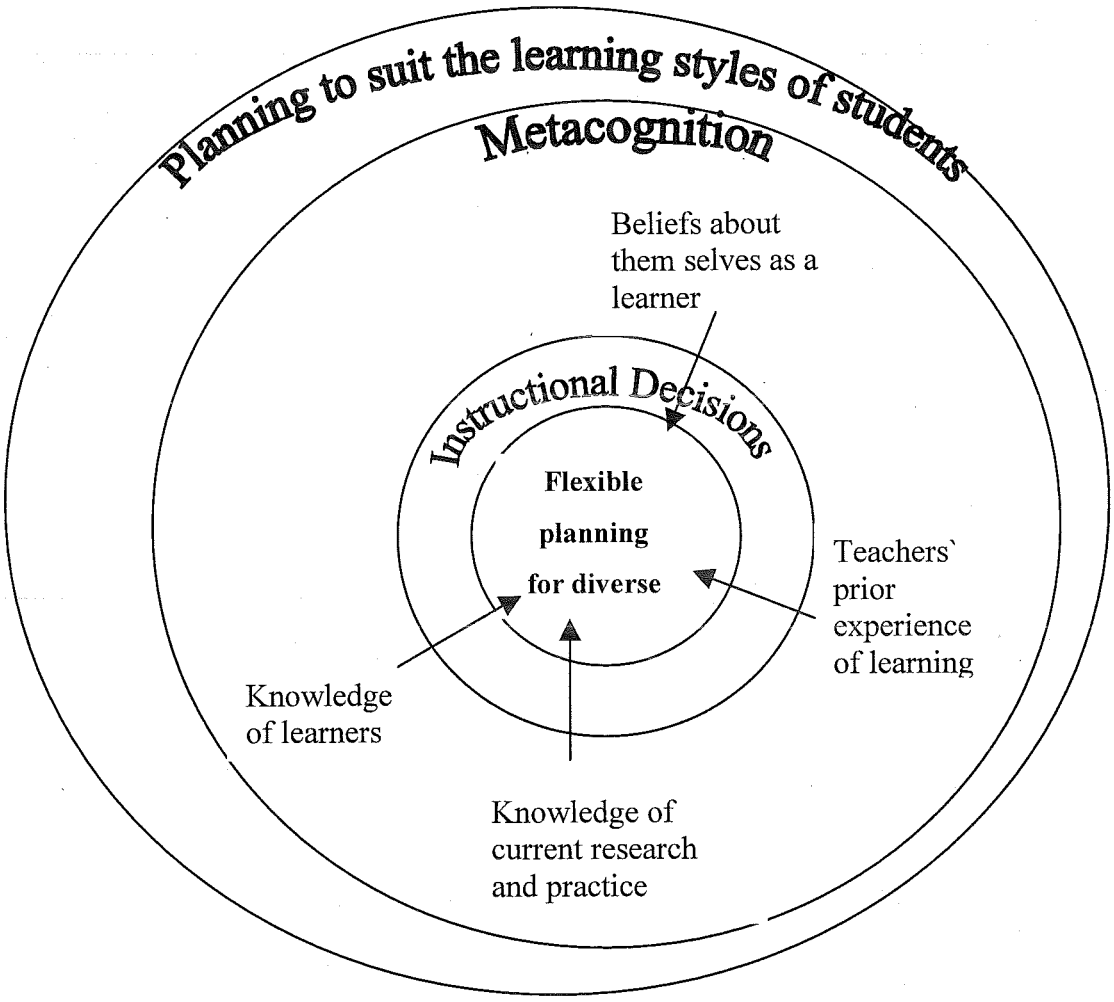


Figure 8: A conceptual model for the research

In the figure 8 the conceptual model for the research in phase 1 shows the aspects being investigated teacher beliefs and prior understandings about learning, their knowledge of their own learning styles and their knowledge of current research and practice.

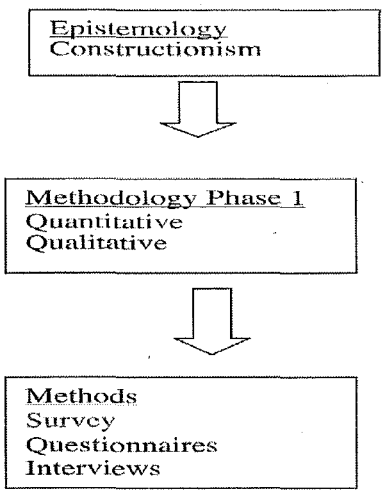


Figure 9: Methodology used in the research

The framework explains the mixed methodology used in the research. The research project is based on a theoretical perspective of constructionism in which knowledge is built or formed in the mind of the participant through active engagement with the constructs. Figure 9 shows the mixed methodology using both quantitative and qualitative research in the study as seen in the data collection methods listed.

3.5 The research questions for phase 1

1) What are these teachers` prior experiences of learning?
2) What is the nature of these teachers' current knowledge regarding research about learning theories and brain development?
3) In what ways do teachers' metacognition of learning styles affect their instructional decisions in the classroom?

4) What are teachers' professional development needs related to research on learning styles and brain development?

3.6 The sample

The population for the study consisted of educators in the Swan Educational District in Perth Western Australia. The population included male and female, indigenous and non-indigenous teachers. Volunteer educators from early-childhood, primary and sectors were invited to participate in the study. The research project surveyed approximately 74 educators primary and early-childhood educators. An additional study was conducted with educators who worked in the family day-care sector.

3.7 The results of the questionnaires

I will now discuss the results of the questionnaires used in phase 1 of the research with teachers. The results of both early childhood and primary teachers have been reported together because they were very similar. The results of work done with family day-care educators will be discussed separately because the group has different demographics, which impacted on the results.

Seventy-four teachers volunteered to participate in the research. All attended a two-hour workshop on learning style theory, current brain research and implications for teachers. They also completed the questionnaire containing twenty-two questions and six questions on demographic data. A selection of the responses related to the demographics of the sample will be discussed below. In the table both frequency, a count of the number of responses and percentage of the number of responses in relation to the size of the group have been included.

Table 1: The gender of the participants in phase 1

Gender	Frequency	Percent
Male	7	9.5
Female	67	90.5
Total	74	100.0

One of the demographic questions gathered data on the gender of the participants. The table above shows the gender of the group being 9.5% male and 90.5% female. This would be fairly characteristic of the gender representation in the group of primary and early childhood educators in Australia, although the male group in this sample is slightly higher than in the general population of primary and early childhood teachers because the many of the participants in the study were curriculum leaders in a district in Perth. This has resulted in an over representation of males relative to the normal population of this group of educators because males are over represented in leadership positions. This has also skewed the years of teaching experience with an over representation of very experienced teachers in the sample. This can be seen in the table below indicating the years of teaching experience of the participants. Fifty-nine percent of the group had more than fifteen years of teaching experience. Fourteen percent of the group had less than five years teaching experience. Thus the data in this study has been obtained from a group of highly experienced and highly competent educators.

Table 2:The years of teaching experience of participants in phase 1

Years of teaching experience	Frequency	Percent
1-4years	11	14.9
5-10years	10	13.4
10-15 years	9	12.2
15-20 years	15	20.3
20> years	29	39.2
Total	74	100.0

When considering the table below on the cultural status of the group it is interesting to note that only one indigenous teacher participated in the study. Thus the results of this research will not be representative of the indigenous Australian population. This is significant because there are a very small percentage of indigenous Australians in the population of qualified teachers which means that much educational research undertaken with the general population of teachers may not contain representatives of the indigenous population which can mean that the results are not necessarily applicable to that group of the community. Thirteen percent of the participants in this study of teachers regarded themselves as belonging to an ethnic minority group.

Table 3:The cultural status of the teachers in the research phase 1

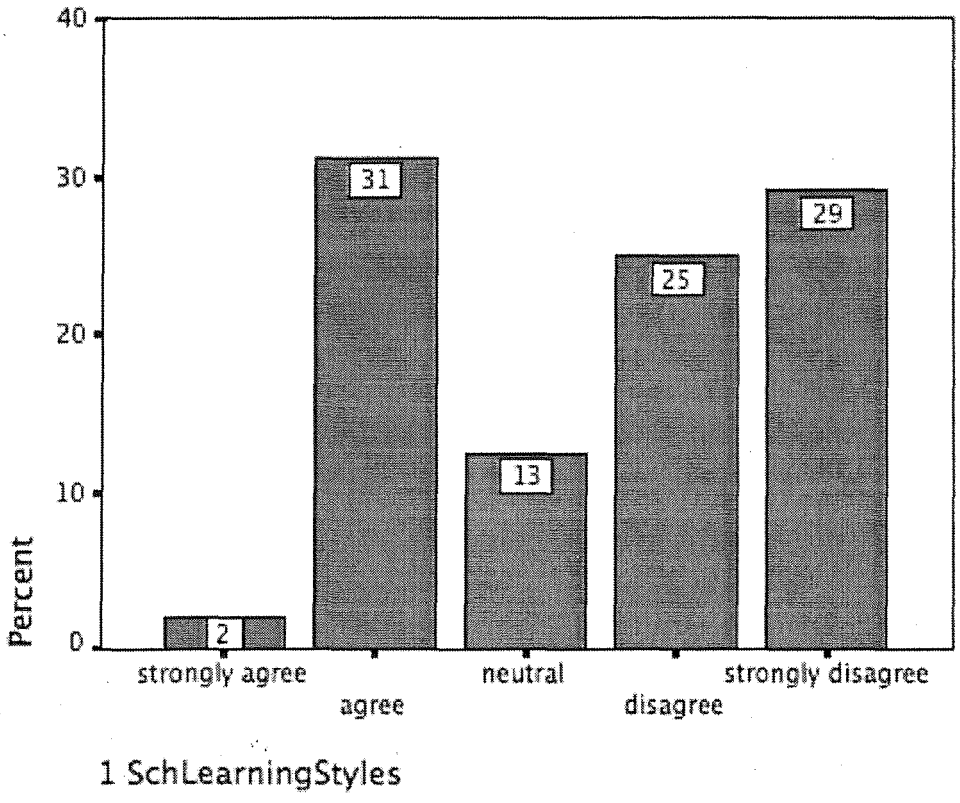
Cultural Status	Frequency	Percent
Indigenous	1	1.4
Non-indigenous	63	85.1
Ethnic minority	10	13.5
Total	74	100.0

The cultural status of the group of primary and early-childhood teachers who participated in the study was significantly different to the group of family day-care educators who also participated in the research. In the family care educators group thirty-nine percent indicated they belonged to ethic minority groups. This influenced their responses to the questionnaire, as some of them did not fully understand the all questions. This was only discovered by the researcher when doing informal interviews with the participants after the presentation. It became evident that many of these participants were migrants with very low levels of fluency in the English language. They also had low levels of formal training, which impacted on their understanding of the questions. This supported my decision to report separately on the data obtained from this group.

In the following section the responses to the questionnaires will be examined to address the research questions for phase 1 of the research. The items in the survey were grouped under three main headings: demographic data, past learning experiences, current understandings about learning and the teachers needs for future professional development. In these sections participants had to tick a box containing a digit linked to a Likert scale with 1 being strongly agree and 5 being strongly disagree. Two open-ended questions gathered qualitative data. In these participants were asked to name their preferred learning style and to describe when they learn best.

We will now discuss the findings of the research, addressing research question 1: "What are these teachers` prior experiences of learning?" In the section collecting data on past learning experiences participants were asked to reflect back on their own experiences at school. This question: "My school teachers based their instruction on a knowledge of the different learning styles of the learners." drew a mixed response from the participants as seen in figure 10. Thirty three percent agreed or strongly agreed with the statement while fifty four percent disagreed with the statement. Twenty-nine percent of the group strongly disagreed with the statement while only two percent strongly agreed indicating a strong sentiment opposing the statement. A further thirteen percent remained neutral on this issue, as seen in the bar graph for figure 10.

Figure 10: A bar graph showing responses to item 1



Item 2 of the questionnaire included the statement " I was made aware of my learning style and needs at school". Seventy-seven precent of the group of teachers disagreed with this statement. To check for clarity on this issue the item was rephrased for item 3 " My learning style was not catered for at school."

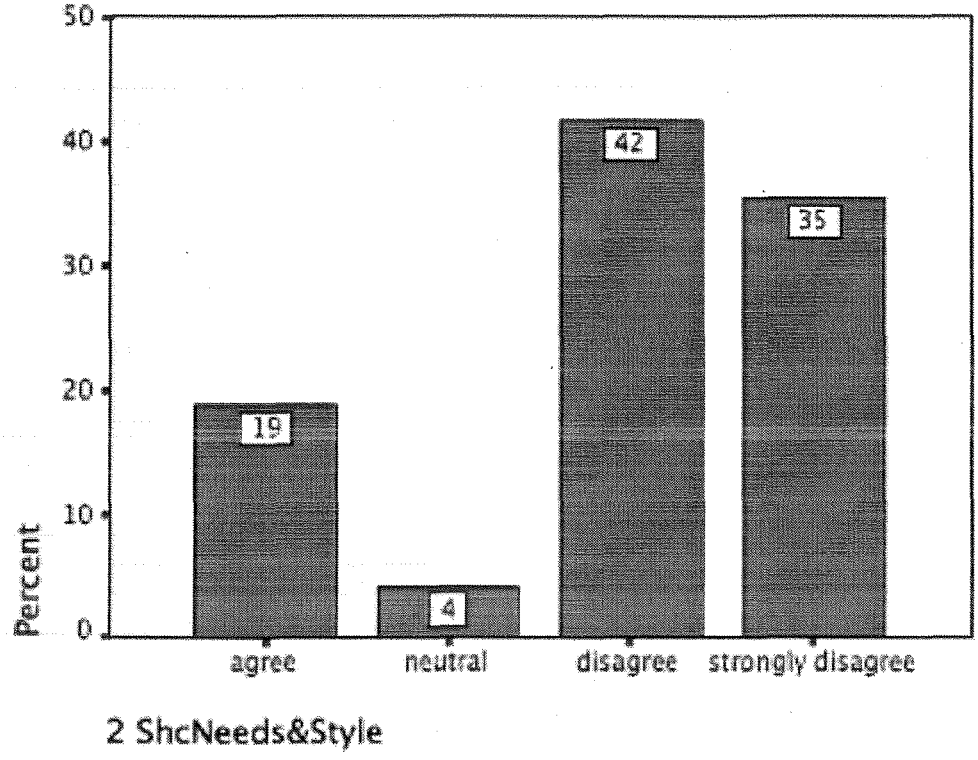


Figure 11: A bar graph showing responses to item 2
" I was made aware of my learning style and needs at school"

In item three of the questionnaire fifty percent of the group agreed that their school had not catered for their learning style. Nineteen percent remained neutral indicating that there may have been some confusion over the meaning of this question or that it was a difficult question for teachers to answer.

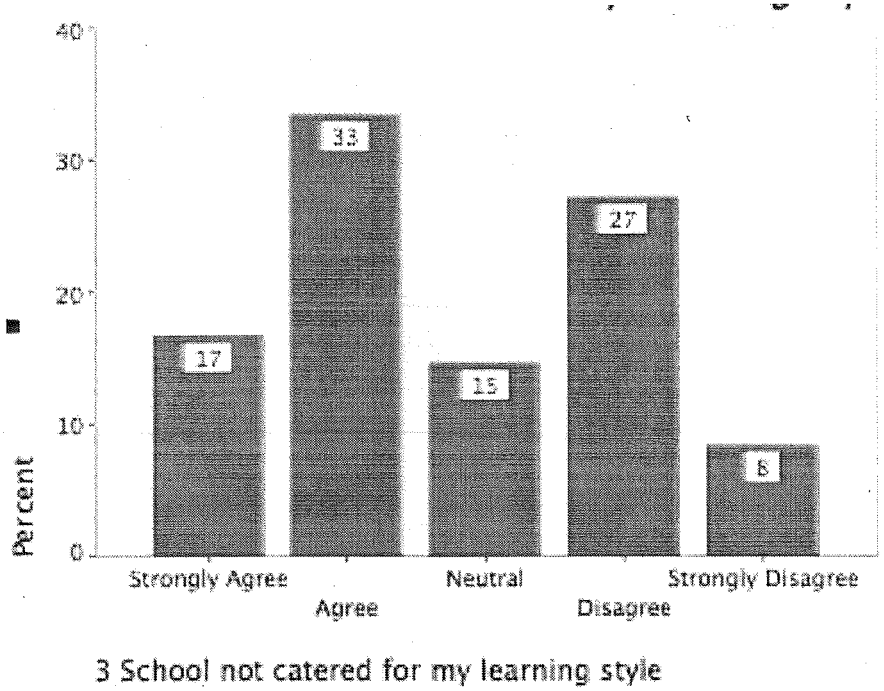


Figure 12: A bar graph showing responses to item 3

Item 4 in the questionnaire stated: " At school I was given a range of strategies to help me learn more effectively." The majority of teachers in the sample did not agree with the statement, seventy-one percent opposed the statement. Thus the majority of the participating teachers felt that their learning style was not accommodated when they were at school and that they were not given strategies to help them learn more effectively.

The next two questions dealt with the teachers` experiences during their teacher training. Question 5 stated, "During my teacher training I received sufficient training on how to determine a learners learning style and needs." Sixty-five percent of the respondents disagreed with this statement, with only twenty five percent agreeing and ten percent remaining neutral. Thus only one quarter of these highly competent teachers, curriculum leaders felt they had received enough information on learning styles and needs during their initial training. The majority of these teachers, eighty-four percent of these teachers trained in Western Australia, with four percent training in South Africa and four percent in England. There were no significant differences in the responses to these questions from teachers who had trained in other states or countries. Question 6 stated " During my teacher training I received sufficient information on current research on brain development and its` implications for teachers." Sixty-six percent of the teachers did not agree with the statement with only fifteen percent in agreement while nineteen percent were unsure. Once again the teachers felt their

training did not include enough research-based material on brain development and the implications for teachers.

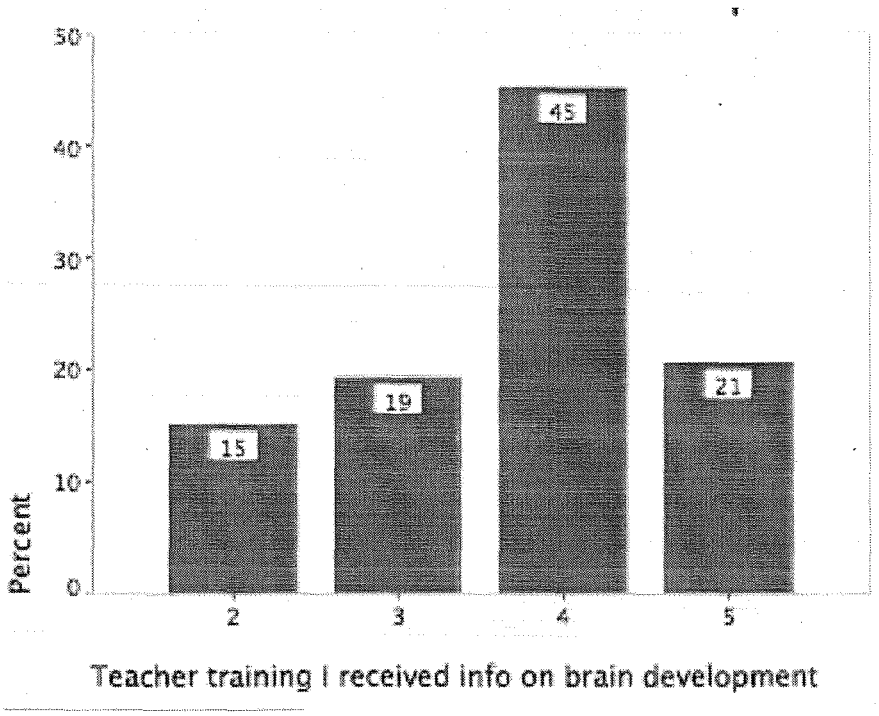


Figure 13: A bar graph showing teachers` responses to item 6

In summary the data collected in response to research question 1; "What are these teachers` prior experiences of learning?" revealed that the majority of the teachers in the study felt that their learning needs had not been catered for when they were at school and that they had not been made aware of strategies to improve their learning. They also reported that in their teacher training that felt that they did not learn enough about how to accommodate the learning styles of their students. They also reported that they had not learnt enough about brain research and brain development and learning.

We will now discuss the data collected in response to research question 2 "What is the nature of these teachers' current knowledge regarding research about learning theories and brain development?" and research question 3 " In what ways do teachers' metacognition of learning styles affect their instructional decisions in the classroom?"

In the next group of questions on current understandings about learning I investigated if teachers felt this type of evidence based research about brain development and learning styles would benefit their teaching. The following statement was made in item 9 of the questionnaire "Knowledge of my own learning strengths and

weaknesses will help me understand the learning strengths and weaknesses of learners in my class." This elicited very positive responses with eighty-nine percent of the group agreeing while only four percent disagreed with the statement.

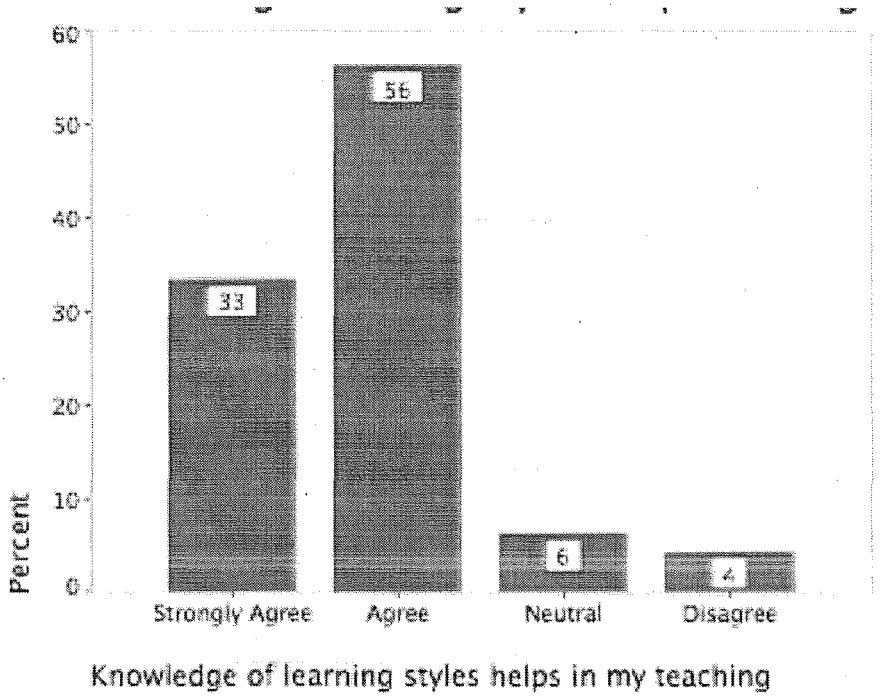


Figure 14: A bar graph showing responses to item 9

Item 10 in the questionnaire stated, "Teachers can help learners to learn more effectively by making them aware of their learning styles and preferences." Again teachers responded very positively with ninety-two percent agreeing with the statement. These responses from teachers indicate that teachers feel that a knowledge of current research on brain development and learning as well as learning style theories can be beneficial in their teaching and can enhance learning outcomes for their students.

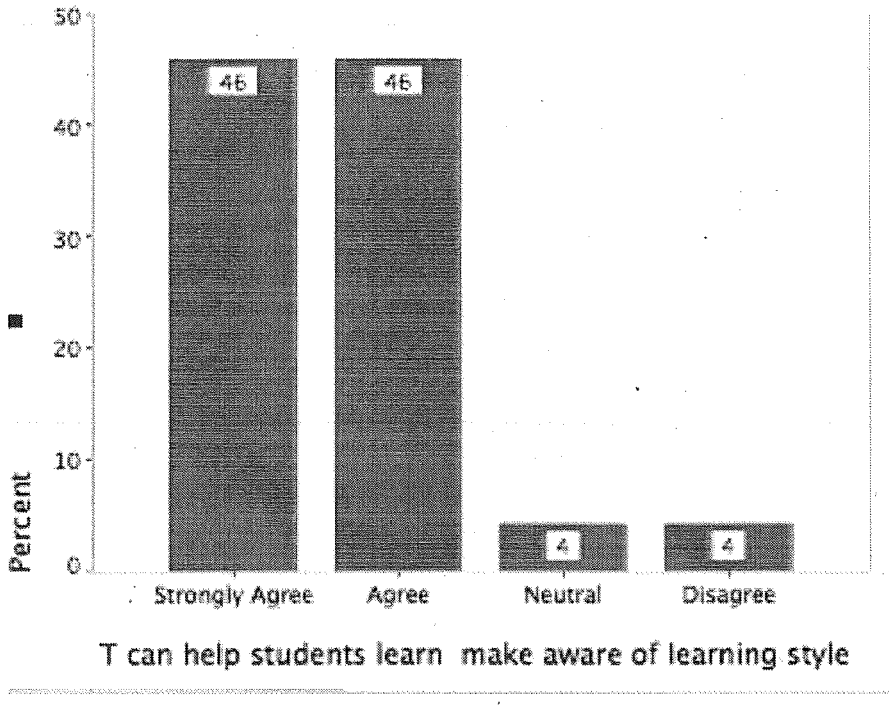


Figure 15: A bar graph showing responses to item 10

Items 15 and 16 encouraged participants to reflect on their own learning experiences and how they influence the way they teach. In item 15 the statement "The way I was taught at school and university influences how I teach. " this drew mixed responses from the group with forty percent agreeing that their past learning experiences will impact on their teaching while twenty-three percent disagreed and thirty eight percent remained undecided.

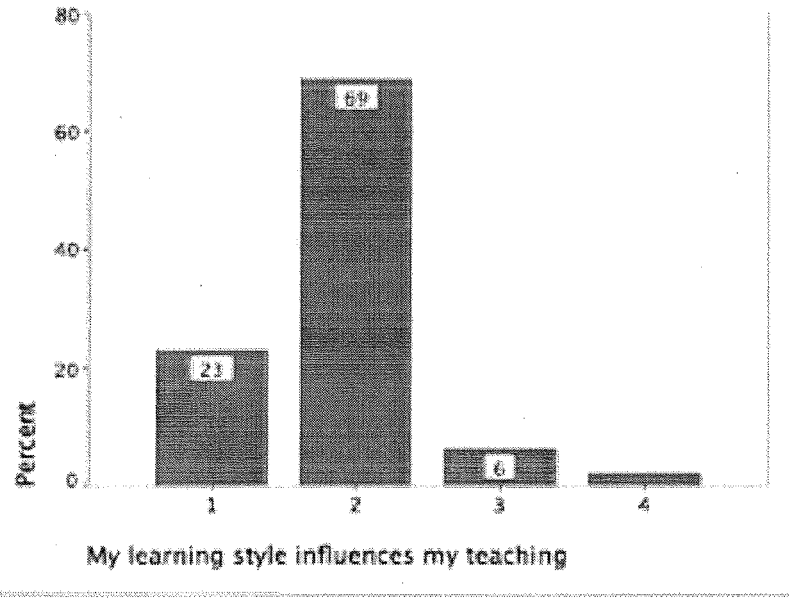


Figure 16: A bar graph showing responses to item 16

Item 16 contained the statement "My own learning style influences my teaching." Ninety-two percent of the teachers agreed with this statement.

The data gathered from teachers in response to the research questions 2 and 3 reveal that the majority of teachers feel that by integrating a knowledge of learning style theory and research on brain development and learning into their teaching they can help their students to learn more effectively and they can plan their teaching to accommodate the learning needs of their students.

We will now address the forth research question, "What are teachers' professional development needs related to catering current research on learning styles and brain development?" The data gathered from teacher revealed that although these teachers seemed to feel that their learning style played an important role in their teaching and impacted on the learning outcomes of children in their classes many of them, over one third of the group, had never attended any professional development on the topic, another third had not attended any professional development on the topic since 2003 five years ago. Only one third of the group reported they had attended professional development on the topic in the last four years. A large number of the teachers could not name their preferred learning style while others gave broad descriptors of how they like to learn but did not have the correct terminology or the theoretical underpinnings of current research on the topic. One teacher described she liked to learn best "when my husband is busy and my children are in bed" while another teachers` descriptors were more self reflective "I am stimulated, challenged to be creative and original, when I can use my hands to make something. I like to problem solve, and spend time on projects." Yet this teacher was not able to use a common language or terminology to describe her preferred learning style. It was difficult to categorise the preferred learning styles of the teachers because the terms they used varied in all there were twenty six different combinations of styles used to describe the learning of the teachers. A large number of the teachers used terms related to a bodily kinaesthetic style for example " hands on, practical, moving, doing, making".

There were also a number who described their learning styles as being solitary involving working alone, reading and memorising. These are quite different to the styles of learning and teaching advocated in current curricula and preferred by many younger students. The preferred learning styles of generation Y will be discussed in the next phase of the research with pre-service teachers.

The final questions gathered data on the teachers needs for professional development. In these six questions teachers indicated very strong needs for professional development in a range of areas related to current research on brain development and learning style theories.

Table 5: Medians indicating teachers` needs for professional development

Topic	Median
Information for learners on learning	2
Practical strategies to cater for diverse classes	2
How to determine the learning styles of learners	2
Research on brain development and implications for teachers	2
How to adapt teaching to cater for learning styles	3
How to plan assessments to suit learning styles	2

Table 5 shows the medians for the frequencies indicating the teachers` needs for professional development. The medians for all items relating to future professional development for teachers are in the range of 1 or 2. This is linked to a Likert scale with 1 indicating strongly agree and 2 indicating agree. Thus table 5 shows the high levels of agreement expressed by teachers on items requesting more professional development on topics related to current research on brain development and learning style theories as applied to teaching situations.

Table 6: Professional Development needs of teachers in the study

I would be interested in receiving more information:	Agree	Neutral	Disagree
How you learn (For students)	92	4	4
Practical strategies to cater for diverse classes	98	0	1.4
How to determine the learning styles and needs of learners	98	0	1.4
Current research on brain development and the implications for teachers	95	2.8	1.4
How to adapt my teaching to cater for the learning needs and styles of learners	97	2.8	0
How to use multiple assessment methods to cater for the learning needs and styles of learners	95	4.2	0

As can be seen table number 6, the teachers in the study expressed a lot of interest in receiving professional development on a range of topic related to current research on learning styles and brain development. There was a ninety-eight percent agreement on the need for more professional development on all of the topics suggested. This indicates that these teachers have the need for further learning on these topics.

Current curriculum documentation in Western Australia makes direct statements about supporting the learning styles and needs of learners yet these very experienced teachers are indicating that this was not adequately covered in the pre-service teacher education or in on-going professional learning. This indicates that there is a need to include this information in pre-service teacher education courses and to provide high quality professional learning for teachers.

It was interesting to note the qualifications of the teachers in the study. The majority of the teachers participating in this research were identified as curriculum leaders in their schools. Thus it would be fair to assume that these would be senior teachers. Yet very few of them have higher degrees or post-graduate qualifications. Sixty three percent of the group have a three or four-year under-graduate qualification, which is the minimum requirement to teach. Fourteen percent indicated that they had a three year qualification yet are teaching in schools. This could have been an error maybe they ticked the incorrect box on the survey however all the questions were arranged in the same way.

Only nine percent of these teachers hold honours or masters degrees and there were none with doctoral qualifications in this group. In many other countries teachers are expected to have masters degrees. When one considers the high needs expressed by teachers in this study for further professional learning it would support the development of accredited courses within universities, which could be linked to career pathways, and salary incentives for teachers. These could be delivered using flexible modes of delivery so that teachers could continue working and not have to attend regular face-to-face classes. This subject of flexible delivery of courses and the use of technology to learn will be discussed further in this portfolio.

Table 7:The qualifications of the participants in phase 1 of the research

Qualifications	Frequency	Percent
3yrs	11	14.9
4yrs	40	54
Grad dip	20	27
Masters	3	4.1
Total	74	100.0

3.8 The outcomes of the study

The results of phase one of this research in which teachers highlighted short comings in their pre-service teacher education which had left gaps in their professional knowledge led me to reflect deeply on my own teaching. I am the co-ordinator of a pre-service teacher education course. I spent much time considering if I was meeting the

learning styles and needs of my students in the courses I delivered. I came to the realisation that I did not really know what the learning styles or needs of my own students were. This prompted further phases of this research to investigate the learning styles and needs of my students the pre-service teachers and to consider if I was meeting their needs in both course delivery and content. This was the catalyst for phase two of research undertaken with a group of first year pre-service teachers. This resulted in the reconceptualisation of one of the core units to accommodate the learning styles and needs of the students by implementing a practical "hands on" approach and the inclusion of a range of digital technologies to support their learning. This research and subsequent transformation of my own teaching will be described in a later section of the portfolio.

3.9 Professional development for teachers

As a result of these questionnaires a number of professional development sessions were held for teachers. The research developed a series of professional development programs called "Brainworks". These were specifically designed in the response to the data gathered from the questionnaires. This allowed the research to tailor the PD package to the specific needs of the group.
"Brainworks for babies and toddlers" was designed educators of children from birth to three this was followed by "Brainworks 1" which catered for early childhood educators. "Brainworks 2" was designed for primary school educators and "Brainworks 3" for secondary school educators. Details of these professional development materials will be described in the following sections of the portfolio.

I was invited to do professional development in the form of a workshop session with early childhood educators at the Edith Cowan 6th Memorial Conference. The conference theme was Guiding Young Children's Learning for the 21st Century. I presented a professional development session for early-childhood educators called Brain Works 1. Below is the abstract of the paper I presented. The workshop session included activities suitable for early-childhood setting that would accommodate the learning needs and styles of learners. This session was well received and led to a series of invitations to do professional development for groups of educators including family daycare. Family daycare is co-ordinated by Communicare a not for profit organization which provides support for daycare workers who run small play groups in their homes. Many of those who attended the sessions were migrants to Australia whose home language was not English. I found this work particularly meaningful, as the participants

were very enthusiastic. I spent much time in South Africa working with community groups in the not for profit sector as I feel this work is important and makes a contribution to groups in society who do not benefit from education in the formal sector or who do not participate in educational opportunities in the formal sector.

The focus of these presentations was on how to apply the theories of learning and brain development to make them relevant and applicable for early -childhood educators. Participants in the workshops were invited to engage in simple, low cost activities, which could be used in early-childhood settings to promote effective learning and facilitate brain development.

Attendees at the workshops were invited to participate in the research and many volunteered to complete the questionnaire. I subsequently found that many of the participants had very low levels of functional English and thus did not all fully understand the questions in the questionnaire. This has prompted me not to include reports on these results because I don't feel they are fully reliable as many of the participants selected only responses number 1 or 2 throughout the questionnaire. It is possible they wanted to please the researcher by only making positive responses or it could be a language issue. They did request further professional development sessions. I then designed sessions appropriate to their learning needs and presented them to the group. I discover it that there is a need for simply delivered accredited professional development sessions based on principles of adult learning for this sector of the population who have limited English language skills so would not be able to cope in the formal sector.

3.10 Future professional development sessions

I received much positive feedback on the professional development sessions for educators. I began receiving more and more invitations to present at individual schools. I came to the realisation that for a number of reasons this was no longer sustainable at this point in time. A major reason for this shift in my thinking was the economic situation in Perth Western Australia. This has been discussed in chapter two and will be expanded in chapter five where I have included a published paper that I have written entitled " The Resources Boom; Cash Cow or Crisis for Pre-service Teacher Education in Western Australia."

This paper discuses the economic situation and how this is impacting on education. The situation of professional development for teachers was starting to be affected by the teacher shortage in Western Australia. Previously the Department of

Education and Training, a major employer of teachers in WA, allowed teachers to attend a set number of hours of professional development during school hours. The department paid for a relief teacher to take the class teachers workload, however due to the teacher shortage in WA 2006 and 2007 the allowances for professional development changed so that it was no longer viable during teaching hours as relief teachers were so difficult to find. This meant that teachers had to attend professional development after school hours. For many schools this was not an option as teachers were already feeling overloaded as many of their hours for duties other than teaching had already been reduced. Principals were starting to cancel professional development sessions had been arranged for their teachers, as they did not want to extend their working hours. Those principals who were now requesting professional development sessions were requesting individual single session presentations. The research on adult learning indicates this is not an effective model of professional development.

The professional development package I had planned for the teachers extended over a period of time allowing teachers to change their teaching practices and engage in more reflective practice. In this process I planned for them to journal or blog the changes in their teaching and how this impacted on the learning of the students. Part of this model was to build learning communities of practice where teachers would engage in peer-to-peer learning, supporting one another. None of this was achievable under the current situation in WA. There were also personal factors. I was lecturing fulltime with a large workload co-ordinating a post graduate course over two campuses as well as completing my own course work units. This meant I needed to use my time carefully and to use it well. I decided that the most effective way of using my time would be to reflect on these principles of learning in relation to my own pedagogy. By embedding these principles that I was advocating to teachers, in accommodating the learning styles and needs of the students and modelling them in the courses I teach I could reach large numbers of future teachers. This prompted the extension of the project to pre-service teachers. This shift in direction to examine my own practice was a very significant change and led me on a personal more inwardly reflective journey. This process in which I reconceptualise my work with pre-service teachers is documented as part of phases two and three of the research. This will be discussed in chapters four and five of the portfolio.

References chapter 3

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3.12 Conference presentations

I did a number of conference presentations throughout the research process. I will now discuss the presentations based on phase one of the research. Doing these presentations was integral to the research as the peer reviews I received provided valuable feedback on the work in progress. I also benefited by sharing my work in a public forum and networking with the academic community. The feedback I received from these presentations helped shape and develop the work as it progressed. I often found the peer support and networking at the conferences a most valuable sounding board from my ideas and a motivator to help me sustain my enthusiasm during those years of doctoral research, which can be quite lonely and isolating.

These presentations are described below; one of them was my first trip and presentation in another state of Australia, Brisbane. This was quite daunting as I had never been to Brisbane before and did not know anyone there. I was pleasantly surprised by the warm welcome I received from academics and the amount of interest they displayed in my work being done in Perth. My presentation was the last presentation of the day and a number of participants stayed after the official paper and asked me to show them more about the work I was doing with pre-service teachers. They showed a lot of interest in my use of new technologies. I shared with them through an impromptu presentation the work I was doing reconceptualisng my courses for pre-service teachers integrating technology. There was particular interest in my work using digital video analysis in pre-service teacher education. The interest of these senior academics from Griffiths` University encouraged me to expand my work in this area. This work will be described later in this portfolio

3.13 Conference paper WAIER Conference

Western Australian Institute for Educational Research Conference August 2005

I selected this 20th annual forum of the Western Australian Institute for Educational Research, (WAIER) held in Perth as the first public presentation of my proposed research. The feedback I received at this early stage helped to refine and shape the research project.

Title of presentation: Determining the professional development needs of teachers and pre-service teachers regarding learning styles.

Abstract

This presentation will showcase a doctoral research project currently in progress. The increasing use of the World Wide Web for research has changed the way we look at knowledge and learning. Learners no longer need to learn and reproduce a set group of facts. The factors that will remain constant are their own thinking and learning processes. Schools need to change into places where learners are encouraged to think and learn effectively determined by their own cognitive style. Few teachers have been encouraged to explore their own thinking and learning. Very little support in the form of resources has been provided to schools to encourage the effective teaching of brain compatible thinking and learning strategies (Haynes & Haynes, 1996). There is a wealth of current research in the area of neuroscience, learning and thinking which is not included in many teacher education courses.

A significant factor in the development of effective learning communities could be the congruence between the cognitive styles of the teacher and the cognitive styles of the learners. Data will be gathered from teachers to determine their current understanding of their own learning processes and their needs for professional development in this area.

3.14 Conference paper Griffith's` University

Griffith's University organized the 3rd Annual International Conference on Cognition, Language and Special Education Research in December 2005. I presented a peer reviewed paper on my research findings for phase 1 at this conference. The conference was entitled Stimulating the "Action" as Participants in Participatory Research 2–4 December, 2005 Crowne Plaza Surfers Paradise, Gold Coast, Queensland, Australia. The theme I presented under was "Teacher education for the professional regeneration of teaching and learning in new times."

Title of the presentation: Effective learning research in a knowledge-based context: What do teachers want to know?

Introduction

I present this paper from the perspective of a teacher educator. I work at Edith Cowan University in Perth Western Australia, which has one of the largest teacher education faculties in Australia. I frequently am asked to provide training for professional regeneration for in-service educators to keep them current with the latest research in the area of curriculum and learning theory. I am also currently involved in the reconceptualisation of teacher education courses to provide the most current training in curriculum areas for pre-service teachers. This need for professional regeneration in the teaching community has initiated this investigation "Effective thinking and learning research." (Lane, 2005). This paper is a report on the progress of a research project that is currently being implemented. The paper will outline the nature of the project and descriptions of the three phases of implementation. Problems encountered in the implementation will also be discussed.

The rationale

A dilemma for teacher educators is how best to equip current and future teachers to meet the rapidly changing demands of teaching and learning in new times (Hughes, 2004). This paper explores the influence of teacher training, past learning experiences and current knowledge in establishing teacher's and pre-service teachers beliefs on

learning and how these beliefs impact on the instructional decisions they make in the classroom.

Teachers in our schools face many challenges. The rapid advances in technology have led to a vast quantities of knowledge generated over the last decade. Some of the major changes in our society are computerization, rapid advances in technology, globalisation and political tensions in many areas of the world (Long & Stuart, 2004). Students of today have grown up in an information rich environment, they need to develop higher order metacognitive skills to effectively deal with this glut of information (Hargreaves, 2003). These global changes in our society have lead to changes in curriculum in schools. The implementation of an outcomes-based curriculum in Western Australia and many other states in Australia has changed the emphasis from the delivery of content to the use of deep learning and thinking skills to reach a desired outcome (World-Bank, 2002).

A large percentage of teachers in Australia are over forty- five years of age and completed their initial teacher training more than twenty years ago, this indicates that they may not have had exposure to the most current research in the field of curriculum, cognitive psychology and learning theories (Gardner, 1999, 2004). They could be in need of professional development in order to regenerate their knowledge base and skills in order to cope in new times.

The shifts in educational thinking towards an inclusive education system, has provided the opportunity for teachers to utilise multiple modes of instruction and assessment to allow learners to demonstrate their learning in different ways. These changes have created many opportunities but also many challenges for educators and ultimately for teacher educators.

According to Fullan (Fullan, Galluzzo, Morris, & Watson, 1998) the need for change in teaching is critical,

> *"In the absence of qualified, committed teachers, working very differently from the present, it is not possible to build an educational system that produces citizens essential for the kind of knowledge-based society that we now have".*

Teacher educators, need to critically examine the curricula to see if it is adequate to prepare teachers and pre-service teachers to cope in classrooms of the future (Groundwater-Smith, Ewing, & Le Cornu, 2003; Hartocollis, 2005). Recent research has begun to address the importance of teacher beliefs and current understandings about the teaching learning process. Teachers need to have a metacognitive understanding of their own learning and thinking before they can transfer this knowledge to their

classroom situations (Long & Stuart, 2004; Pink, 2005; Young, 1998). These understandings prompted the design of a research project to gather data on teachers and pre-service teachers prior learning experiences, current understandings about learning and their needs for future professional development. The design of the research project will now be discussed.

The research project

In this research a combination of qualitative and quantitative methods are used. Quantitative methods are used to analyse survey data on teacher's knowledge of their own learning styles, learning theory, their previous training and their needs for future professional development. Descriptive statistics are analysed to find areas of need for professional development. Qualitative approaches are used to gain an understanding of the thoughts and feelings of the participants in the study to determine their metacognitive awareness of their own learning styles. Interviews are used to gather rich data on participant's feelings, perceptions and beliefs of their learning and learning theory and how this influences the selection of instructional strategies. Interviews will be used to get further data on the precise nature of teachers needs for future professional development in this area. The questionnaires include some open-ended questions to gather qualitative data, which adds richness to the research. An action research cycle incorporating peer observations and reflections will be used to aid the transfer of new understanding about effective learning to daily classroom teaching.

The significance of this study is meeting the needs of teachers who are faced with groups of learners in their classes who learn in new and different ways. The approach of using students learning styles and needs as a way to plan, teach, and assess whole classes while accommodating the individual needs of learners is current and relevant for teachers. The study promotes a metacognitive awareness of individuals learning processes in both teachers and their students (Livingston, 1997; Splitter & Sharp, 1995). The Professional Development materials to be developed as a result of this study will assist teachers to be aware of their own learning needs, styles, beliefs and current research in the field of cognition and learning theory. A practical application of this research is to promote an awareness of the use of multiple instructional and assessment methods, which cater for the learning needs, and styles of learners.

Phase 1

Phase 1 of the research utilises a questionnaire, interviews and focus groups to explore educators and pre-service teachers past learning experiences, current understandings about learning. Data is gathered on the needs of educators and pre-service teachers for professional development to enable them to cope in outcomes- focussed classrooms where the key element is the teaching learning process not the content being transmitted (Kornhaber, Fieros, & Veenema, 2004; Macintyre Latta, 2004; Woolfolk, 2004). The data will be analysed to determine the professional development needs of the participants. This will result in professional development materials being develop for the participants.

Phase 2

In phase 2 of the project the professional development, materials will be developed with the participants. An action research model will be used (Hopkins, 2002). Participants will be encouraged to apply the new understandings in their classrooms and to reflect on their practice. A system of "study buddies" will be implemented to enable participants to work with a partner, who will be invited to view their teaching and document constructive changes seen in the teaching. This will culminate in a collegial discussion between teaching partners to reflect on the teaching- learning process and set goals for future teaching. This information will be shared with the researcher leading to modifications in the professional development materials so that they become more effective in meeting the needs of educators. The professional development will be designed to give teachers an awareness of their own learning and thinking processes and to transfer this knowledge to the classroom situation. Participants will be challenged to apply this metacognitive understanding to teaching scenarios(Kornhaber, Fieros, & Veenema, 2004; Macintyre Latta, 2004; Woolfolk, 2004). This is in line with current thinking in creating inclusive learning environments (Fogarty, 1997) and the philosophy of outcomes-based education.

The implementation

This project is currently in phase 1. Approximately 100 early childhood and primary school educators have participated inn the project. The data has been gathered on their

past learning experiences, their current understandings about learning and how this influences their instructional decisions in the classroom. These volunteers have completed an anonymous questionnaire. The multiple intelligences model (Fogarty, 1997; Gardner, 1999, 2004; Kornhaber, Fieros, & Veenema, 2004; Morgan, 1997) has been used as a strategy of how teachers can adapt their instructional strategies and assessment methods to accommodate the diverse learning needs and styles of the learners in their classes. The researcher has also used interviews and focus groups to gather data. The data has been analysed both qualitatively and quantitatively. Inferences from this data have been used to develop initial professional development materials.

Problems encountered in the implementation of the research

An initial problem was to get volunteers for the project. Teachers have heavy workloads and are hesitant to get involved in extra paperwork. I then presented at a conference and invited delegated to participate in the project. Through this appeal, an adequate number of volunteers were sourced. A school principal indicted willingness to adopt the project as a whole school renewal project. This school has become the site for future phases of the project.

Another problem has been balancing a full time lecturing job with time-consuming research and data analysis activities. I am still having difficulties in this area and would welcome advice from other researchers. I now invite questions or comments from the audience.

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Research phase 2 Investigating the learning needs of pre-service teachers

Ch 1 Introduction	Ch 2 Lit review	Ch 3 Research Phase1 Teachers	Ch 4 Research Phase 2 Preservice Teachers	Ch 4 Research Phase 3 Post Grad Students	Ch 4 Research Phase 4 Technology in teaching	Ch 5 Future of Teacher Education	Ch 6 Conclusion

Figure 17: Portfolio progress chart chapter 4 phase 2

The findings of the work done with teachers in phase 1 led me to explore those topics with pre-service teachers in our under-graduate four-year B-Ed program. After observing and informally investigating the learning styles and needs of the under-graduate pre-service teachers I started to build up a profile of how they wanted to learn and what instructional strategies worked with this group. Over a period of a few years I spent many hours listening to the students and monitoring the formal and informal feedback from pre-service teachers. I discovered that learning using technology was a mode of learning used by many of our students. I was able to search the literature and find out general trends of students in the same age group falling into the group commonly called Generation Y but I needed more specific information on the preferred learning styles of the students in my course. Thus I expanded the original questionnaire on learning styles and understandings about learning used with teachers in phase 1, to include a section on the impact of technology on the learning of first year pre-service teachers. Initially a group of first year pre-service teacher education students undertaking one of my units were invited to participate in the study after the completion of a new unit of study.

4.2 Ethics for phase 2

In order to conduct research with another sample group an amendment was submitted to the ethics committee of the university. The questionnaire was modified to obtain information from pre-service teachers on their preferred learning styles and needs. Data were also collected from the students on their use of technology and if they preferred to use technology for learning.

4.2.1 Aims of phase 2 of the research project

Current research indicates that educators need to be aware of the learning needs and preferences of students`, to help ensure that the instructional strategies and the methods of delivery best suit the learning needs of the group. The second phase of this research project was being undertaken in order to determine whether my own students, pre-service teachers' learning needs and styles were being met in a new core unit EDF1105. This new unit was designed in response to students` requests for more integration of technology in the unit materials and more active pedagogy. I wanted to check if the newly designed unit was effective in supporting the learning of students. I also wanted to see if the technologies incorporated in the unit suited the learning styles and needs of the group. I wanted to see if the content contained in the unit about learning styles helped students develop deeper understandings of their own learning.

The research project phase 2 will culminate in the further development and improvement of teaching materials and the adoption of instructional strategies, which will serve to improve teaching to pre-service teachers. The research will also serve to raise pre-service teachers metacognition of their own learning styles and preferences and the range of learning differences they will encounter when teaching. This research will be used for the preparation of journal articles and conference presentations by linking current research on learning, specific data on the learning needs of pre-service teachers and practical strategies to be used in teaching. This will also give us feedback on the students` perceptions of the value for learning of the technologies used in this unit to support.

4.2.2 Consent from the participants

Participation in the research was voluntary. The surveys were anonymous and did not contain any identifying data. All participants were informed of their right to withdraw from the research project at any time. There was no risk to the participants.

4.2.3 The dual role of researcher and lecturer

In this project the researcher had a dual role of researcher and lecturer this could be a cause for potential conflict of interest. To minimise any confusion the researcher explained the situation to the participants. Throughout the course the students were kept informed about the lecturers research interests. The findings of the research would be shared with the students adding authenticity to their learning. The information letter, which was given to the participants, clearly explained the lecturers' role as a doctoral student and gave reasons why the data was being collected and how the findings would be used. It was emphasised that participation was voluntary and that there was no coercion of students to participate.

4.2.4 Recruitment of participants

Participants were recruited from pre-service teachers enrolled in a unit on learning theories. The research project was explained to the participants in one of their final tutorials sessions. They were provided with an information letter clearly explaining the rationale behind the research. Students were then invited to participate. It was clearly explained that participation was voluntary and anonymous. Participants were asked to complete a questionnaire. A sealed box was placed in the tutorial room. Participants were asked to post their responses into the posting slot in the box. This ensured that only the researcher was able to view responses. Students were reassured that participation or non-participation in the survey would not influence their assessment in the unit in any way.

4.2.5 Information letter to the participants

Participants were provided with an information letter clearly explaining the project. Written consent was not obtained because the questionnaire was anonymous and by completing it, the participants were giving their consent.

4.3 Details of research procedures

Pre-service teachers were asked to complete a questionnaire at the completion of a unit of study. A letter of explanation accompanied the questionnaire. The questionnaire was anonymous. There was no way to identify the participants. Participation was voluntary. The results of the questionnaires were quantitatively analysed using SPSS software. Qualitative analysis of specific questions was undertaken to expand on themes. All records were kept in a locked filing cabinet in the researchers office at the university.

4.3.1 Methodology

I replicated the methodology that was used in phase 1 of the research. Mixed methods were used in the research, a combination of qualitative and quantitative methods. A questionnaire was given to volunteers. The questionnaire was followed by a focus group held for a small group of volunteers. An independent researcher moderated the focus group.

4.4. Research questions-phase 2

1. What are these pre-service teachers` prior experiences of learning?
2. What is the nature of these pre-service teachers' current knowledge regarding research about learning theories and brain development?
3. In what ways will pre-service teachers' metacognition of learning styles affect their instructional decisions in the classroom?
4. What are these pre-service teachers' professional development needs related to research on learning styles and brain development?
5. How does the use of technology in this unit impact on the learning needs of pre-service teachers?

4.5. The questionnaire used in the study

A questionnaire was used to gather data from participants. The participants were asked Likert style questions about their current understandings, prior experiences and future needs for professional learning on the topic of learning styles and theories of learning. Open-ended questions generating qualitative data were included, for example: My own learning style is… and I learn best when…

These open-ended questions revealed interesting information about the way these first year pre-service teachers liked to learn. These questions were all identical to those questions asked of teachers which would allow comparisons between the understandings and needs of teachers and first year pre-service teachers. For this group of pre-service teachers additional sections were added on their use of technology for learning

4.6. The results of the questionnaires

A coding schema was developed to categorise the choices made by participants about their preferred learning styles. Some students listed one learning style whereas others had a combined or multi-modal style. The students who completed this questionnaire had completed a unit where they had done two or more learning style surveys. They analysed the surveys, compared and contrasted the results of the surveys in relation to their past learning experiences and came to a conclusion about their preferred learning style. The main conclusion that could be drawn from the data collected from these questionnaires was that there was a range of different learning styles in the group. Overall visual and kinaesthetic styles were included in the majority of the students` lists of preferred learning styles.

Table 8: The coding used to group the learning styles of pre-service teachers

Code	Style	Category	Combined category
1	Visual	1	
2	Auditory	2	
3	Kinaesthetic	3	
4	Social	4	
5	Solitary	5	
6	Linguistic/ verbal	6	
7	Musical	7	
8	Intrapersonal	8	
9	Logical mathematical	9	
10	Visual/auditory	1,2	Vis-multi
11	Visual/ kinaesthetic	1,3	Vis-multi
12	Visual/intrapersonal	1,8	Vis-multi
13	Visual/linguistic	1,6	Vis/multi
14	Visual/ kinaesthetic/intrapersonal	1,3,8	Vis/kin
15	Kinaesthetic/social	3,4	Kin-multi
16	Visual/ kinaesthetic/ logical mathematical	1,3,9	Vis/kin
17	Kinaesthetic/linguistic	3,6	Kin-multi
18	Kinaesthetic/linguistic/intrapersonal	3,6,8	Kin-multi
19	Intrapersonal/ social	8,4	Social
20	Musical/ visual	7,1	Vis-multi
21	Musical/ kinaesthetic	7,3	Kin-multi
22	Interpersonal/ linguistic	6,4	Social
23	Visual, kinaesthetic, linguistic/ musical	1,3,6,7	Vis/kin/multi
24	Social,visual, linguistic	4,1,6	Vis-multi
25	Intrapersonal, kinaesthetic,linguistic	8,3,6	Kin-multi
26	Intrapersonal,Linguistic,kinaesthetic,visual	8,6,3,1	Vis/kin/multi

4.7. The benefits of the research

The findings of the research were made available to the university to use in unit development. This helped to improve the structure and delivery of units of work to pre-service teachers. The process of participation in the research modelled the importance of self-reflection on their learning to the participants.
The findings were submitted to peer reviewed journals for publication and made available to the broader community. The results of the research were used in the further development of professional development courses for teachers and pre-service teachers.

4.8. The outcomes of the study

An outcome of the research was the further development of a unit for all first year teacher education student students called becoming a more effective learner. The research data gathered from pre-service teachers indicated that they wanted to learn more about learning theories, specifically about how to understand their own learning style, how to learn more effectively and how to accommodate the learning styles of children when they are teaching. They also indicated that the majority of teacher education students preferred to learn using new technologies. These factors were used in the design of the unit materials. Details of the design of the unit are described in the follow sections of the portfolio.

Figure 18: The logo developed for the new unit

The content of the unit is focussed on effective learning and the theories that lie behind learning and motivation. We used highly interactive lectures and workshops to engage students in exploring theory and analysing relevant practical applications in authentic school contexts. We were the first teacher education program in Australia to use Lessonlab ®, this web-based learning portal allowed students to interact with streaming

video sequences of authentic teaching in WA classrooms. However, we also made a conscious endeavour to link the theories we were discussing with the students' own experiences of learning. The unit was designed so that all students become empowered, self-directed learners through investigating their own learning styles, levels of motivation and worked on strategies to assist themselves to become more effective learners and to set goals for future studies.

4.8.1 An innovative unit design integrating new technologies

The modular design allowed students to progress through the materials at their own pace to suit their learning style and lifestyle. All the learning materials, resources and assignments were placed in the online learning management portal at the beginning of the semester so students could access them whenever they needed them. This supported the learning styles of those learners who preferred a holistic approach to learning and liked to have access to all the course materials to develop a bigger picture approach to learning. A senior academic and an expert in their field of online learning reviewed the Lessonlab online interface making the following comments

The online learning site designed for the unit EDF1105 follows good interface guidelines and is well-structured providing easy navigation for students. The sites interface is attractive, encouraging use. The designs of the online tasks are interactive making students apply their knowledge rather than passively viewing video footage. In use the students need to engage critically with the video case studies as they deconstruct the teaching processes thus linking their understanding of theoretical constructs with the examples of authentic classroom teaching. As a teacher and lecturer of ICT on education of 22 years experience I am concerned about the problems students encounter not being able to access technology. Jenny and her team used lateral thinking to overcome this problem. When the team discovered that not all students had access to high-speed broadband they included the video components on a CD-ROM, making the materials accessible to those who only have dial up internet access at home.

4.8.2 A unit design, which accommodates the learning-needs of the students

Many of these students fell into the 18-25 year old age range; this puts a large number of the cohort into Generation Y. Generation Y are the children of the baby boomers, the first generation to grow up with computers in their homes and schools. They are accustomed to having instant access to information; they use technology for communication, information and recreation. They are often very visually orientated learners (Bank, 2002) who often prefer to use technology to for learning than traditional print based media. These students have often failed to engage when the traditional print-based readings were used, and easily became bored needing additional visual stimulation to support learning. Knowing the demographics of the group led to innovative choices in the design of this unit to cater for these Generation Y learners. In the design of the modules a range of web-based resources were integrated to encourage students to do extended reading and research on each module of work. The rich use of technology in this unit modelled to our students how to successfully integrate technology into teaching. Some of our students have reported that after seeing the technologies used in this unit they have integrated technology-based projects such as web quests, talking books, interactive Power Point quizzes and web links in their own teaching in schools.

Many of these students indicated they preferred to learn in active ways, to accommodate these preferred learning styles of the students a range of interactive tasks were included in all tutorial sessions.

In this unit student were given opportunities to engage in problem solving activities and then reflect on how they coped, and what strategies they used? They were also encouraged to try a range of different strategies to solve problems and then see which of these strategies they could use in the future to become more effective problem solvers and learners. Previously students covering problem solving would be presented with a list of problem solving strategies. The difference in this unit was that they had to personally experience the challenge of solving difficult problems. Then they had to work with their peers to generate their own list of strategies and finally they had to test the strategies to see which strategy worked best for them. The students reported that they found this a very challenging and confronting way to learn, but they enjoyed it

because it was authentic and suited their preferred way of learning as the tasks were practical and allowed them to work collaboratively with their peers.

Figure 19: Students engaging in interactive tasks

4.8.3 The use of digital media

The initial plan was to take a traditionally paper-based, face to face course and reconceptualize the pedagogy to include social constructivist principles of learning (Dalgarno, 2001). A web-based course management system called Lessonlab was chosen because it could offer the look and feel requested by the students as well as a number of additional interactive features.

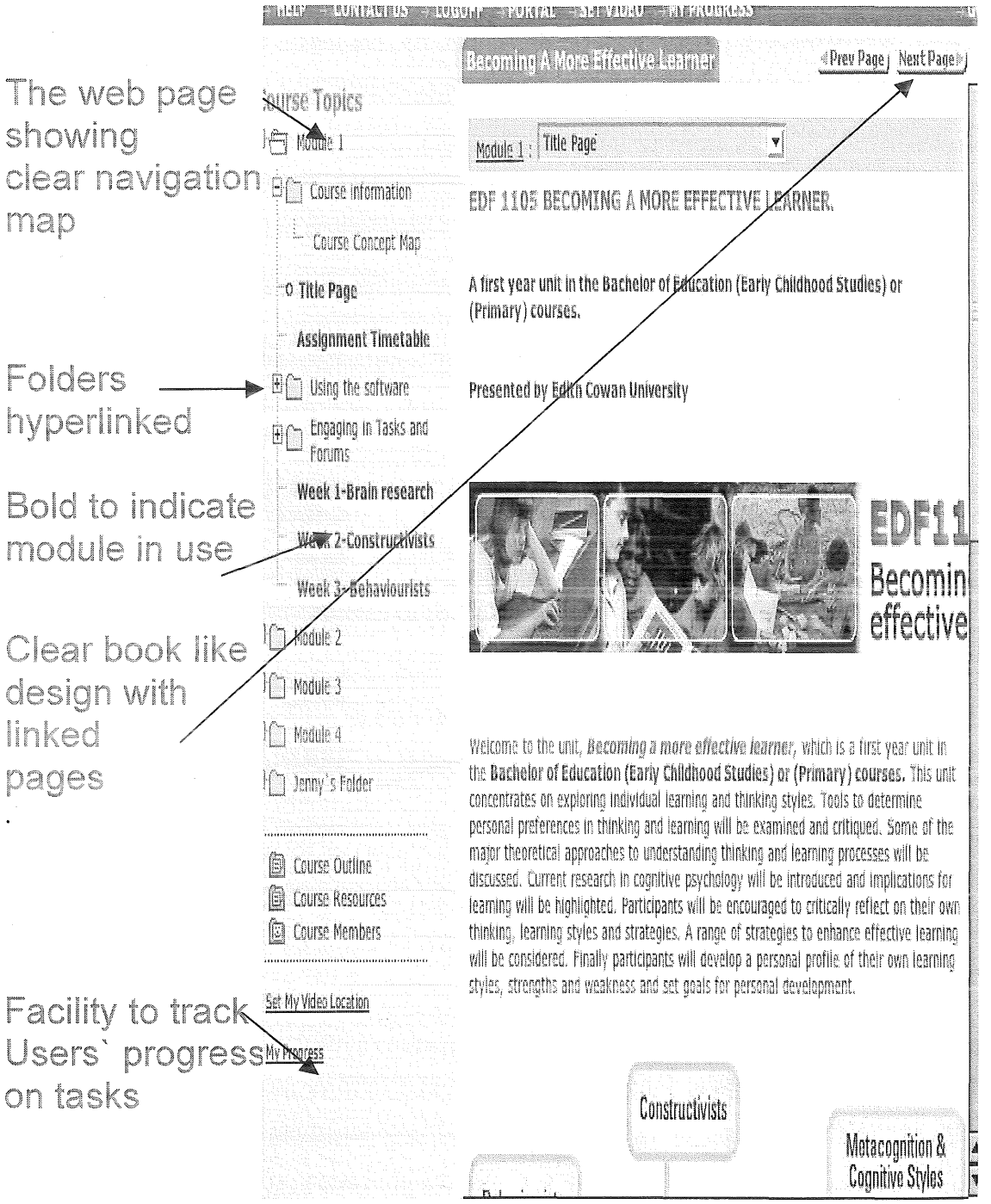

Figure 20: The design of the web page

The Lessonlab platform pages were written in html coding. This allowed for the inclusion of graphics and animated GIF`s creating a visual appealing look and feel. The platform included "lessons" and "tasks". These were interactive activities, which the designer built in various formats. They were created with various options; one option was to allow students to view other student's submissions once their work had been posted. This created rich learning experiences for the student to engage in peer -to peer

learning and raised the quality of the written tasks. Another feature was the collation of data from online surveys. The data was then displayed in graphical forms allowing comparisons between groups, which could be analysed and presented to the students to facilitate discussions.

The technology also allowed students to monitor their own learning by letting them clearly see their progress on tasks. This facility also allowed the tutors to see which students needed encouragement to stay on task.

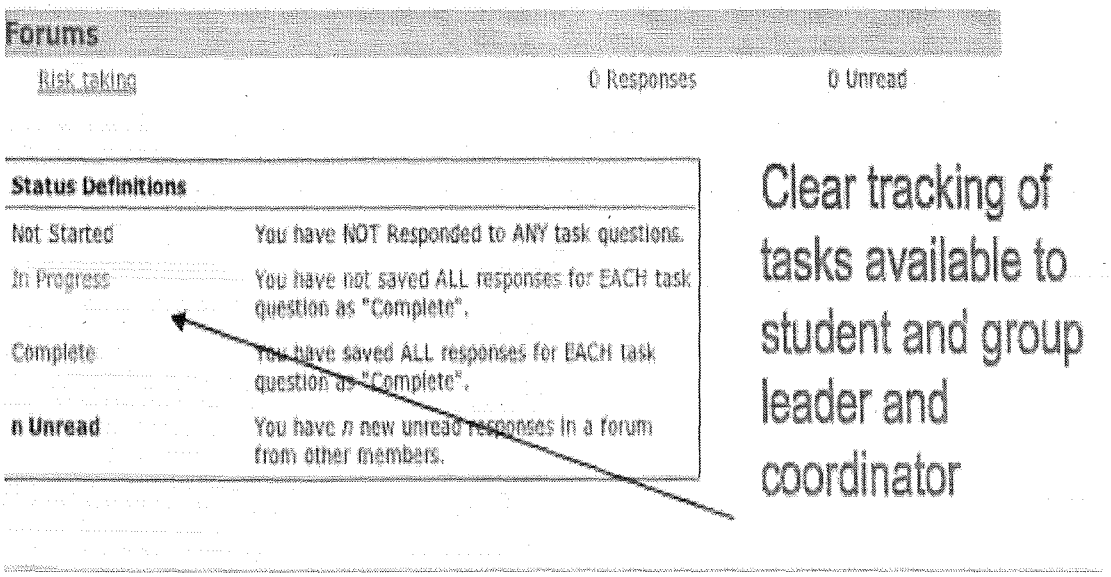

Figure 21: Task tracking facility

4.8.4 Bridging the digital divide to engage students.

A few of our first year university students were not competent users of computers. We also had a large proportion of female students in our education units and a few mature aged students. Current research indicates that many females lack confidence and experience in the area of ICT and use of technology (Anderson, 2000; Cassell, 1998; Douglass, 2004). As our students are going to become teachers and will need to use technology, we felt it was important to embed technology into this first year unit. We tried to use the females' preferences for social learning situations with a purposeful application of technology in the design of resources for this unit.

Through a research project investigating tertiary students leaning needs and learning styles we discovered that many of our learners preferred to learn using visual

materials (Lane, 2005) . We catered for these visual learners by using a web-based platform with a range of graphics, animations and video clips. We used the web-based platform to hold teaching and learning resources and as an interactive learning experience involving the analysis of digital video footage.

We decided to go into schools and film authentic situations of how teachers cater for the learning styles of students. This made the learning authentic and allowed transcendence or bridging of theoretical constructs into practical situations. We included learning experiences where the students viewed video footage and inserted digital marker tags. The markers were linked to a commentary which the students wrote showing applications of theories of learning in teaching settings. This methodology of using authentic video case studies has proved to be effective in pre-service teacher education (Louden et al., 2005).

4.9 The outcomes of the changes in the unit

The outcomes of the effective implementation of this new exciting unit design included the creation of a highly interactive, technology-rich program of study, consistent with contemporary learning principles.

- The development of an effective community of learning shown by higher levels of student satisfaction, as evidenced by high UTEI results with large classes (Mean overall satisfaction for this unit was 16% higher than the faculty average in Semester 2 2006);
- Higher student performance levels in assessments (particularly critical thinking: analysis, synthesis, problem-solving), and improved transfer of skills and knowledge across courses and into the workplace;
- Greater student confidence in the use of learning technologies;
- Improved staff expertise in the use of learning technologies;
- More efficient use of resources and expertise for teaching and learning;
- Improvement in student retention and engagement;

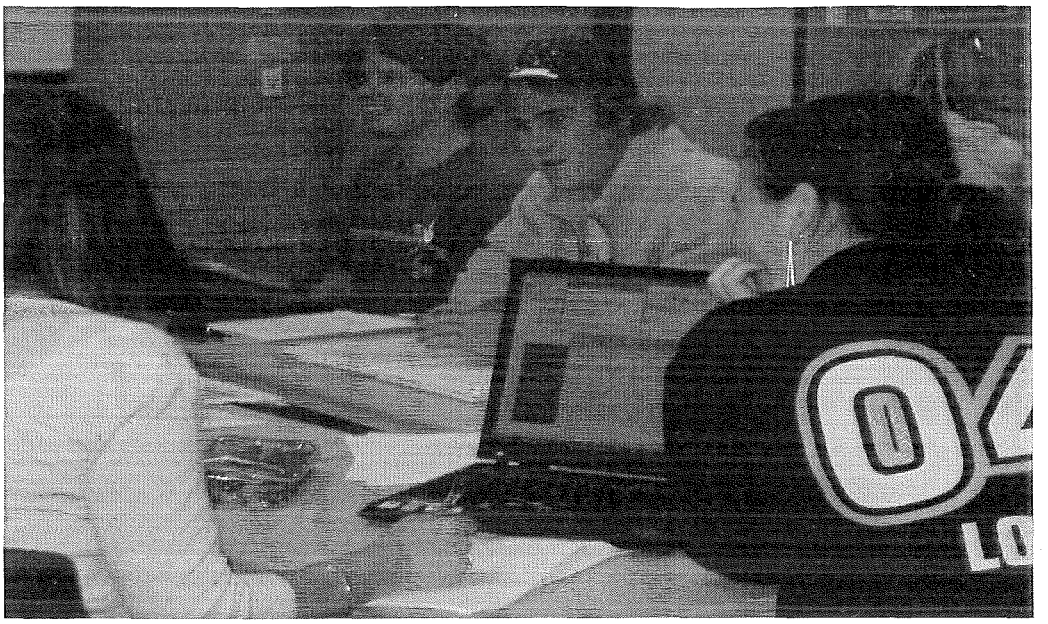

Figure 22: Students engaging in discussion groups using laptop computers for research

Through this unit, we took our students on a journey of self-discovery about their own preferred ways of learning. They participated in online learning style surveys to come to conclusions about their own preferred learning style. We then led them through a range of interactive activities in the lectures and tutorial workshops to equip them with the new tools and strategies they needed to help them to become more effective learners. This was a very empowering experience for our students as they discovered aspects of their own learning styles for the first time (Burns, 2002). We also helped them to discover areas of weakness where they lacked strategies for learning or applied ineffective strategies and exposed them to current research on effective learning so that they could select strategies to strengthen and enhance areas of their learning performance.

One of the theoretical premises introduced in this unit is research in the field of cognitive psychology which supports the premise that all can learn but may do so in different ways (Fogarty, 1997; Gardner, 1999, 2004). We empowered all our students by getting them to reconceptualize their thoughts on the nature of intelligence and thinking. As stated by Quicke, (1999,p.11) "From an epistemological viewpoint, there have been changes in the way we typically understand the nature of knowledge and what it means to know".

We introduced our students to the concept of metacognition which can be simply described as thinking about their own thinking (Sternberg & Ben-Zeev, 2001). Ranges of activities to encourage self-reflection are presented to the students. Students

are shown simple steps to develop self-reflection using a model to structure their reflections. We also explored how to solve a range of problems and analysed the strategies used by effective problem solvers. This empowered students by giving them a wide range of strategies, skills and tools to use when solving problems. The overall approach in this unit is we liked to encourage students to experiment and to try new approaches and strategies to learning and problem solving. We aimed to create a safe space in which students could use new skills without fear of failure. All students in the unit wrote a reflective journal tracing their learning journey. These are the comments of one student, which are typical of the comments expressed by many of the students,

I believe that since starting this unit, I have learnt more about myself (motivational factors and learning dispositions) that I will be able to monitor my learning style and myself. I will be able to learn more effectively... which will benefit my life greatly.
(Student comment from a reflective journal)

In Module 4 of the unit entitled " Yourself as a learner" we aimed to extend the learning of our first year students. Traditionally first year students have been described as surface or superficial learners. In this unit the students were encouraged to engage in deeper levels of reflection encouraging authentic learning. After identifying their own learning styles through completing online learning style surveys and engaging in class discussions, the students explored their dispositions to learn, experimented with new learning styles and set goals for future learning. As they identify their own strengths and weaknesses as a learner they engaged in further levels of reflection moving to higher levels of thinking where they reconstructed knowledge coming to new realisations about their own learning and thinking.

The following results from the Semester 2, 2006 UTEI results for this unit show the students found this unit highly engaging and began thinking metacognitively about their own learning. The UTEI (unit teaching effectiveness index) is an independently administered evaluation of teaching and learning in which student gave anonymous online ratings for units they have completed. This data was used to monitor and improve unit quality.

Table 9: Student ratings of the effectiveness of this unit

Item	No of respondents	Agree	Mean
The unit challenged my thinking	102	87	72
The unit advanced my understanding	100	97	74
The unit enhanced my knowledge and skills	102	97	71

The data shown above comes from the UTEI an independent, anonymous teaching evaluation conducted by the university on all units each semester. These online surveys use five point Likert scales ranging from strongly agree to strongly disagree to rate units. This unit has consistent scored well above the average scores for large units on many aspects for example, the mean agreement score of 72% for the item the unit challenged my thinking and the mean of 74% for the unit advanced my understanding indicates that the majority of students rated this unit highly from a learning perspective. This is evidence that the instructional strategies used in this unit, engaged students and promoted learning and understanding of new content. Many of the students have stated that they wished they had been aware of these aspects of their own learning earlier in their lives.

This letter from a student (21/02/2007) reflects the sentiments of many students:

> *When I enrolled in your course "Becoming an Effective Learner" I really didn't know what it would all be about. I was pleasantly surprised at the end of the semester with all the information you gave us and have put most of the good advice to good use. It was amazing for me to realize that although I have always been a very organized person, I was not time managing myself correctly and therefore, not taking any time off to relax and my levels of stress where somewhere up there! I do it now as a matter of routine. I also have learnt how to motivate myself by giving myself rewards and fun activities to look forward to one my tasks are done. I was also fascinated to learn about the neural plasticity of the human brain and that even though I am an adult, the more you use it, and the*

more it develops. This has been a powerful motivator to keep me studying. My other fascination was Gardner's multiple intelligences and the different ways in which we learn. This was a great eye opener to me as when I am in a real classroom, I fully intend to give children opportunities to use all the intelligences in order to empower them with something they will be able to use for the rest of their lives. By discovering the ways in which I learn best has also given me an insight into how best to prepare myself now and in future studies. I also liked it very much when you taught us about the importance of creativity with its never-ending possibilities. What a fabulous thing to do, create and think, stretch the imagination, which has no bounds, and not feel ridiculous when admitting it to others!! Your course was invaluable to me and I can't thank you enough for helping me understand myself better. (Student letter)

The research was undertaken to gain insight into student engagement and learning using the new technology in this unit. This research was presented at the National Australian Computers in Education (ACEC) conference in 2006. This peer-refereed paper was one of the few papers selected for the DEST innovation strand. This supports the claim that the work done in the redesign of the unit was very innovative. The paper was elected for publication in the conference proceedings and later was selected for republication in the ACEC Journal. The full paper Digitising our learning can been seen in item 4.12.3. An expert in teaching and learning; an Associative Professor, the Associate Dean of Teaching attended this presentation at the ACEC conference from Learning Edith Cowan University, who made the following comments

I attended Jenny Lane's outstanding presentation on Lesson Lab at the Australian Computers in Education Conference (ACEC) held in Cairns in early October 2006. Having attended many presentations at this conference on the use of technology in enhancing teaching and learning I was particularly impressed with Jenny's creative and rigorous application of lesson lab in her units at ECU. It was clear to me that this technology not only supports quality teaching and learning, but also had been meticulously developed to ensure easy access and student engagement. Testimony to Jenny's innovative work with Lesson Lab was the enthusiasm with which her audience asked questions and made comments about its enormous potential it had within their particular work contexts. At the end of her presentation there was a real reluctance to let Jenny finish. She spent some

time chatting to a group of university lecturers who were most complimentary and interested in her work.

The Primary Program Director made comments referring to the redesign of this unit as can be seen below;

> *EDF1105 Becoming More Effective Learners is an excellent example of the impact of reconceptualising the Bachelor of Education (Primary) course. The unit clearly encapsulates course principles including the embedding of ICT competencies, development of information literacy skills and a constructive pedagogical approach within a student-centered environment. Using the lesson lab digital platform the unit is immediately motivational due to its visual appeal and the use of interesting, educative learning activities. Anecdotal comments I have received from students have been most positive.*

Figure 23: Students engaging in "hands on" activities to suit their learning styles

4.9.1 References chapter 4

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4.10 Integrating technology into preservice teacher education courses

At this point in the development of this portfolio I was thinking a lot about how to integrate technology into the courses I design and teach. I was beginning to trial new technologies and started doing research on my practice. This research has been documented in a number of published papers, which I have included below.

4.11 Publications

During the doctoral course we were encouraged to develop publishable papers from our investigations. In the following section I have included some of the peer-reviewed papers that I have published which have links to the research and the doctoral units I studied. I have included the papers as separate entities maintaining the original formatting.

4.11.1 Gender, technology and learning styles

This peer reviewed paper was published in Australian Educational Computing, the journal of the Australian Council for computers in Education December 2005 volume 20 no 2. p.11-15. The paper was motivated by my research which indicated female preservice teachers lacked experience and confidence using technology. The paper was published in an issue with the theme of gender learning style and technology. The article discusses the mismatch between learning styles of females and the teaching styles of many technology instructors, who tend to be male and the outcomes for female learners. It continues to recommend teaching strategies in technology classes that will engage female learners and suit their learning styles.

4.11.2 The digital divide: Are our girls falling through the gap?

Jeniffer Lane, Edith Cowan University

Abstract

The comprehensive Girls Tech study undertaken recently by Rutgers University (The World Bank Douglass, 2004) supports the findings of a number of previous studies (Newmarch, 2000; Scott, 1998; Smith, 2005; Walker, 2002) which indicate that some females still view technology as a threatening part of male culture. There is concern about the low percentage of female learner engaging in technology-based courses at a secondary school levels (Comber, 1997; Hough, 2004; Wilcox, 1996). This paper is a search of current literature on brain research and gender based learning. The literature reports that some females prefer specific styles of pedagogy to suit their cognitive processing preferences. Ranges of instructional strategies are discussed to develop a pedagogy that engages girls in technology-based classes.

> *Immense progress has been achieved in education over the past 50 years. Immense challenges still remain. The main success has been access, but too many people- especially women and girls are still excluded at all levels of education.* (Education Sector Strategy, (World-Bank, 1999a)

Introduction

This is a review of literature that addresses a concern in technology-based education: Young girls are not responding as well as boys to technological opportunities offered in our education system (World-Bank, 2002b). My interest in this field has developed over twenty four years of teaching and lecturing experience in the area of primary and middle years schooling. I currently lecture in programs on curriculum studies with an emphasis on the use of ICT in educational settings and inclusive education for early

childhood and primary school educators. I am interested in the impact of instructional design and teaching methodology and how we can avoid gender bias in this field. My current doctoral research focus is in the area of cognitive psychology and information technology and how new advances in these fields can inform teachers to adapt their pedagogy to cater for the learning needs of their students. In this paper several factors affecting the engagement of girls in technology-based learning are outlined. Barriers to the inclusion of girls in technology-based classes are considered from a socio-cultural and a cognitive perspective, and reference is made to current research in the areas of gender, learning theory, educational psychology and cognitive science. Finally, areas warranting future research are highlighted.

The move towards a knowledge based society

There has been a global shift from a society based on producing goods to one based on knowledge production (Bank, 2002; Dutton, 2002; World-Bank, 2002b). This has changed the world of work profoundly. For example, many traditional forms of employment have ceased to exist or have been replaced by more efficient methods utilising technology (Hough, 2004). As can be seen when scanning the employment sections of Australian newspapers, a large percentage of employment advertisements require at least a range of basic ICT competencies (Walker, 2002). The data on rates of remuneration for employment show that many of the higher paying jobs require higher levels of ICT competencies. Hough (2004) describes the advances in information and communication technologies, such as the use of the World Wide Web; Internet based communication and research as drivers of change, leading to the creation of new jobs and opportunities. A large number of new forms of employment have been created which utilise these new technologies.

The initial promise for the increased the use of technology in schools was that it would serve to promote better opportunities for all students (Garnham, 2002). Competencies that were previously restricted to a select few, such as the use of computers as a tool for research and design and access to databases would be made accessible to many. There are, however, many challenges for educators wanting to reconceptualize their pedagogy to incorporate these new technologies to greatest effect, and equip learners to take their place in the technologically orientated society they will face in the future. It is a fair assumption that in order to function effectively in this technological society, individuals need to develop certain levels of ICT literacy (Cassell, 1998; Newmarch, 2000; Walker, 2002). There are numerous references in the literature which state that a lack of skills in the area of technology can become a handicap for learners in their future careers (Comber, 1997; Douglass, 2004; Garnham, 2002; Hough, 2004; Smith, 2005; Wilcox, 1996).

ICT in Australian Schools

On the surface in Australian schools, all is looking good. There is widespread provision of technology in schools and the majority of classrooms and schools have been equipped with computers for over the past twenty years. But if one delves beneath the superficial impressions, a different picture emerges. There is a marked difference between the number of female and males students enrolled in ICT based subjects in Australian high schools and this discrepancy seems to be growing. In 2002 only 22% of students enrolled in year twelve ICT subject Information Processing and Technology were female. For example, in Queensland girls' enrolments in higher level computing subjects remained static at 7% over a five year period whereas male enrolments rose from 17% to 25% (Stieler, 2005). The proportion of women enrolled in undergraduate

tertiary ICT subjects in Australia is approximately 19%, decreasing as the levels of the coursework increase (Anderson, 2000; Scott, 1998). It follows that there are significantly fewer female students than male students in these courses at a postgraduate tertiary level. These figures are in stark contrast to the data on general school achievement, where females are tending to out perform males. If female students continue to avoid participating in these opportunities to develop their competence in ICT they are at risk of being excluded from many avenues employment in the future. Considering the importance of ICT skills outlined above, this raises the following question: What are possible reasons for girls' lack of engagement with technology? Hence the literature searches for this paper.

Gender and learning

There are many indications of gender learning differences in the take up of new technology. Gender-schematic theory proposes that an individual's sex is biologically determined, but that the individual socially constructs gender on an ongoing basis. Young women can be influenced by societies' stereotypes, which designate what activities and skills are socially acceptable for women. This can lead to young women being discouraged from pursuing interests in a technology related field (Douglass, 2004; Wilcox, 1996). Another consideration is the way that females learn (Fogarty, 1997; Gardner, 1999, 2004; Guenther, 1998b). Whilst they do not all learn in the same way, there is a distinct range of learning styles preferred by female learners. Females tend to prefer learning that is language-based, involving discussion and collaborative group work. Females tend to become stressed by situations that are too competitive and those that involve violence or aggression. Females also tend to enjoy working in environments that are attractive and nurturing (Anderson, 2000; Cassell, 1998). I will

return to these preferences below when discussing an appropriate pedagogy for girls in ICT.

Females` attitudes towards technology

Recent studies show that some females view technology as a threatening part of male culture (Comber, 1997; Smith, 2005; Wilcox, 1996). Comber (1997) related young women's lack of confidence regarding computer use to the time spent using computers for recreational purposes. Research indicates that adolescent girls spend less time playing computers games and using computer technology in their recreation time. A number of research studies report that this is because most computer games are designed by and for males (Comber, 1997; Douglass, 2004; Smith, 2005). Newhouse and Bursey indicated that boys were more likely to experiment with new software than girls, although with increased exposure girls gained confidence in using a new program (Newhouse, Bursey, S., 2004).

A comprehensive study "Evaluating electronic information resources for young women" was undertaken recently by Rutgers University (Douglass, 2004). This research project found that many females find computer games aggressive and that they target traditionally male-orientated interests. Games based on competition, rules, demonstrating mastery over opponents, and reactive violent responses do not appeal to many female players. The literature reports that females prefer collaborative, authentic problem solving with plausible female characters (Cassell, 1998; Douglass, 2004). The dearth of well-designed computer software appealing to females could be a reason for young females spending less recreational time engaged in computer-based activities, and for their lack of confidence, which has been termed gender related self-doubt

(Comber, 1997). However, there are emerging examples of software design that is appealing to both male and female players, for example 'The Sims"computer game uses family themes which are appealing to female players (Wright, 2000). Software developers are realising that there is a large relatively untapped market of potential female game players so it makes good business sense to design games that appeal to both genders. This broad ranging appeal made "The Sims" the top selling computer game in the year 2000.

There are other issues of social exclusion, which females have experienced when trying to engage in online communication forums. Wilcox (1996) reports incidents of gender-based intimidation involving "flaming" occurring in online chat rooms. Flaming can be described as immediate, generally negative emotional response to a statement made by a participant in an online environment. This type of harassment can have a sexual overtone when directed towards female participants and has resulted in some females avoiding participating in online chat groups and forums. This behaviour reinforces the stereotype that these forums are for male participants, which limits females' exposure and experience in this area. The literature also reports incidents of boys` dominance in computer use in classrooms and the denial of female learners` access to computers (Cassell, 1998).

Brain research and gender based learning

Research in the field of cognitive science has revealed new evidence about gender differences in the human brain (Gazzaniga, Ivry, & Mangun, 2002; Pinker, 1999). The Nobel Prize winning research of Sperry (1991 cited in Woolfolk 2004) on split-brain theory supports the idea that females often use less of the right side of the brain than

males for working through complex mathematical based problems. Thus girls use less of the more holistic, intuitive thinking that is most suited to the computer-based environment. Furthermore, the development of new brain scanning techniques has resulted in more detailed information on brain activity in living subjects. Positron emission tomography (PET), developed in the 1970`s, measures increases in blood flow associated with neuronal activity (Dobbs, 2005). Positron scanning techniques now show marked differences in the structure and functioning of male and female brains (Gazzaniga, Ivry, & Mangun, 2002; Guenther, 1998b; Johnson, 1993; Mundale, 1998; Nuckolls, 1998; Pinker, 1999). For example it has revealed that the male brain develops and matures from the anterior areas that control motor skills and physical abilities (Gazzaniga, Ivry, & Mangun, 2002). Whereas female brains show cortical maturation from the frontal areas that control thinking and language skills. The areas in the left hemisphere, namely Brodmann's area, Broca's area and Wernicke's area, which are responsible for auditory-based language, mature and develop at a faster rate in females (Bellugi, 1993; Fogarty, 1997; Pinker, 1999). Thus many females prefer to learn through auditory language-based methods. It could be that the instructional strategies used in technology-based lessons do not promote this style of learning, which could be influencing the level of engagement of female students with technology.

More recently, another method of brain scanning, functional magnetic resonance imaging (fMRI), has been developed. The advantage of this method is that it allows us to watch the brain at work. fMRI scans can produce an image of a cross section of the brain in less than two seconds, and unlike the positron technique, which involves intravenous materials, fMRI scanning is non-invasive. The scan records raised levels of magnetism that occur when fresh oxygenated haemoglobin is detected in neural tissue. This flow is interpreted by researchers to indicate neural activity (Wiles & Wiles,

2003). The fMRI scans measure neural activity by detecting increases in blood flow associated with increased mental activity in a particular region of the brain. However, critics of this technique feel that these scans are still too slow to accurately measure neural activity as neurons fire very rapidly (Dobbs, 2005).

Although this technology is still new, and is not as accurate as scientists would like to be, it can reveal valuable information about brain activity (Dobbs, 2005; Kellogg, 2003; Smith, 2005). This new research shows us that some males and females can prefer to learn in differently. For instance, it reveals that males often use areas in the right hemisphere of the brain (responsible for processing visio- spatial functions), to process abstract tasks. This type of holistic, visio-spatial processing as required in technology-based subjects tends to use the right hemisphere of the brain. The type keyboard-screen interaction is better suited to males, whereas a talking-listening computer would be better for females. Where females predominantly prefer the more linear language- based tasks utilising the left hemisphere of the brain.

Gender, motivation and learning styles

Research in the field of human psychology also shows differences in motivation and motivators, which could explain why males tend to engage in this area and females, do not engage. For example, some studies have revealed that females are highly motivated by the need to be popular (Smith, 2005; Woolfolk, 2004). In co-educational schools, this manifests as a need to be popular with the opposite sex. Could girls be exhibiting a learned helplessness in the area of technology in order to be popular? This could be in line with the norms of socialisation and peer pressure that "girls are not meant to be smart" and the notion that "computers are boys` toys." Research has shown that males are more motivated by individual competition and the need to prove mastery in an area

(Cassell, 1998; Comber, 1997; Gardner, 2004). This type of competitive behaviour is integral to the design of many technology based games and activities.

The literature on learning styles and dispositions has indicated that males are more inclined to take risks than females (Dewey, 1909; Guenther, 1998b; Worrall, 2002b). The successful use of new technology involves taking risks and experimenting. Those learners who lack the confidence or the disposition to learn in this manner are less likely to successfully profit from the use of new technology. The use of positive role models has also been shown to have a significant effect on learning (Comber, 1997; Douglass, 2004; Newmarch, 2000). It is of significance that we are not providing our girls with female role models in the area of technology. On checking the media, a higher proportion of the role models in the areas of computers and technology are male. The image of the computer expert is usually a Bill Gates type figure. Female learners find it difficult to identify themselves with this stereotype presented in the media (D. H. Pink, 2005; Scott, 1998; Smith, 2005). There are seldom examples in popular media and culture of women who excel in the area of technology. Furthermore, a higher proportion of technology instructors are male (D. H. Pink, 2005; Scott, 1998; Smith, 2005). These factors could be influencing the higher levels of engagement of male learners in this area.

Cognitive psychology adds another dimension to this review of technology and gender. There is much research on the significance of matching students` learning styles and the instructional strategies used in the classroom (Buzan, 1995; Fogarty, 1997; Gardner, 1999, 2004; Guenther, 1998b; Kornhaber, Fieros, & Veenema, 2004; Morgan, 1997; Splitter & Sharp, 1995). The research is indicating that the instructional strategies used when teaching technology-based subjects do not match or suit the preferred

collaborative language-based learning styles of female learners. Studies documenting the instructional strategies used in technology-based classes show that teachers use different instructional strategies when dealing with male and female learners (Morgan, 1997; Newmarch, 2000; Wilcox, 1996). When male learners encounter a problem, the teachers tend to encourage them to find a solution to the problem. When female learners encounter a problem, the teachers often solve the problem for them (Scott, 1998; Smith, 2005). This type of behaviour does not encourage the females to be resilient and problem solve but entrenches feeling of helplessness (Anderson, 2000; Cassell, 1998). Although a number of studies, as stated above, report on this behaviour by teachers there is little evidence in the literature as to why teachers treat male and female learners differently in technology -based learning. This indicates the need for further research in this area.

Developing a pedagogy that engages girls in technology-based classes

While clearly more research needs to be done on this topic, one can tentatively propose the following instructional strategies that educators can incorporate into their pedagogy to cater for the range of learning styles and needs of the learners in their classes. Educators need to ensure that software selected for computer and technology based classes are appealing to both genders. There should be a combination of competitive and collaborative work. There should be a balance between individual work and group work. Problems and scenarios need to be authentic and include realistic gender representations of both males and females. The content of instructional materials should not have people engaged in demeaning pursuits or depicted in passive roles (Cassell, 1998; Douglass, 2004). Activities should contain language based linear processes as well as the more global holistic activities.

There should be an attempt to use positive role models of both sexes to motivate learners to participate. Educators should be aware of socio-cultural barriers to participation for some learners, who may have been socialised to think that females are not expected to be good at technology based activities. Educators may need to take active steps to break through the stereotypes that limit engagement of female learners in computer and technology-based classes. Schools can promote female role models who have excelled in the area of technology. They can invite females who are working in the field of technology to speak to the students. Examples from the media of positive female roles models can be shown to the students. Work experience programs can be established so that females develop a realistic picture of what future work in the areas of technology involves.

Schools can encourage young females to engage in recreational computer use by forming gender friendly computer clubs, with some activities based on the collaborative interests of females. If necessary, schools can establish sex segregated computer classes to encourage girls to participate without harassment or domination. Schools could use one of the checklists or guides to ensure computer software purchased will appeal to females, for example the guide developed by the Rutgers University Girls Tech Project (Douglass, 2004). Computer programs like Robolab, which have been specifically designed to encourage the participation of girls, can be promoted in classes at an early age before stereotypes and negatives attitudes towards ICT and technology are established (Fleer, 1995). Schools can make computer software available for loan in their libraries to encourage girls to try out new software. Technology educators can ensure that the technology rooms and computer laboratories are aesthetically appealing to females so that girls feel welcome in these areas.

Conclusion

This is an area in which there are still many unanswered questions and unexplored issues. As noted at the outset, there is a huge demand for workers in our society with technology-based skills, yet we have a large proportion of girls not choosing to follow this line of study in high school. Educators need to change the instructional design and the teaching methodologies to engage the girls in this vital area of their education. Educators need to be sensitive to the numerous challenges and pitfalls when designing learning experiences incorporating technology. There needs to be a synergy between instructional design and teaching methodology that promotes positive learning experiences for both genders. The literature has shown that a large range of factors need to be considered when designing technology-rich learning experiences, for example nature of the content, social stereotypes, the aesthetic appeal of the venue and the design of the learning materials. A significant factor is the instructors` teaching style, which needs to support the preferred learning styles of the students while encouraging resilience and independent confident thinking. Educators must be aware of the dangers of stereotyping and limiting the opportunities of females by over simplifying learning activities. Technology-based classes need to include a range of learning experiences so that learners can select those that best suit their learning style and needs.

Further investigation is recommended on the significance of skills training in this area for the future success of females in the knowledge-based economy. The links between early computer use and later confidence in the area of technology also warrant more investigation. Technology educators and their learners need to be consulted and their opinions sought on how this issue can best be resolved in Australian schools.

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4.12 Digitising our learning

This paper was first presented at The Australian Computers in Education Conference 2006 (ACEC '06). This is the biennial conference of the Australian Council for Computers in Education (ACCE). The ACEC conference is hosted once every two years by the Computer Education Group of a member state or territory. This research on learning and digital technology was peer refereed and published in conference proceedings –*Digitising our learning- An innovative trial of a new teaching technology.* This paper was selected for the DEST innovation stream.

This paper was selected for republication in June 2007 in Australian Educational Computing 22/1 entitled *Digitising our learning: an innovative trial of a new teaching technology.* A copy of the publication has been included below.

At this point in the development of the portfolio I was focussing on the results of the research undertaken in phase two with preservice teachers. The preservice teachers indicated that some of them lacked confidence in using technology although many of them wanted to use technology to support their learning in flexible modes. The students were very positive about the way I had incorporated technology into courses for preservice teachers. As we were the first university in Australia to use this technology incorporating digital video analysis I wanted to share this successful teaching experience with other educators, this lead to the writing of the following peer reviewed conference paper and the subsequent two publications.

This paper was selected for republication in June 2007 in Australian Educational Computing 22/1 entitled *Digitising our learning: an innovative trial of a new teaching technology.* A copy of the publication has been included below.

Digitising our learning: An innovative trial of a new teaching technology.

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This paper reports how digital technologies can be successfully incorporated into traditional teaching programmes to support the learning of a new generation of learners. It describes the introduction of an innovative learning venture with preservice teachers. A web-based platform called Lessonlab was piloted with four cohorts of preservice teachers approximately 600 students, of whom 25% participated in this evaluation. A special feature of this platform is its ability to house streaming video and a range of digital video analysis functions. Research was conducted to determine the effectiveness of this use of digital technology. Quantitative and qualitative data were obtained from participants, which revealed that the majority of participants benefited from this use of technology to support their learning. The study has relevance for all educators who are keen to use technology to promote effective learning and thinking for today's` learners.

Introduction

Every great age has been characterised by growth and change. In past eras, the agricultural and industrial revolutions had far reaching influences on the way people lived, learned and functioned in society (Burns, 2002). Currently we are in the early stages of a digital revolution that has impacted on every aspect of our lives. As educators we are key players in this rapidly changing world. Many educators are concerned about how to adapt and change their teaching to make it more effective for today's` learners. There is a growing realisation that there is a generation of learners entering our institutions that learn and think differently. There are several of reports that indicate that traditional methods of face-to-face teaching are failing to motivate some learners in our institutions, particularly young males (Marsh, 2004; World-Bank, 2002).

This paper describes a pilot project utilising a learning content management system, which houses digital streaming video. A questionnaire and interviews were used with one cohort of learners to determine the effectiveness of this use of technology. Qualitative and quantitative data from this study revealed students attitudes to using technology to support their learning. A new learning management system called Lessonlab was used in a course of tertiary study for large cohorts of students. Design features of this system are described. Advantages of this system are described and problems encountered in the initial implementation are listed. Instructional strategies used to over come difficulties in this pilot study are shared. Future directions and some implications of using digital technology to support learning are discussed.

Characteristics of Generation Y learners

The current cohort of preservice teachers falls demographically into a group sociologists label as Generation Y. These students are mostly in the 18-25 year-old age range. Generation Y are the children of the baby boomers. They are the first generation to grow up with computers in their homes and schools (Sheahan, 2005). There are accustomed to having instant access to information. They use technology for communication, information and recreation. They can be

visually orientated learners with very individualised learning styles (Buzan, 1995; Fogarty, 1997; Gardner, 2004; Lane, 2005).

The challenge for educators of the future is to provide authentic motivating learning experiences for our students. We need to conceptualise the transfer and expression of knowledge in different ways, in order to captivate the interest of these new learners. The hierarchies of knowledge transfer and the stratification between the educator and the learners are no longer clearly defined. To effectively engage today's` learners we need to reconceptualize our pedagogy to provide a seamless, flexible, interface between the learner and the learning.

Research on learning styles and cognition supporting the use of technology

Research in the realm of learning and thinking is claiming that individuals can learn more effectively if their individual learning styles are accommodated. The ongoing work of Gardner, Kornhaber and others in Project Zero at Harvard University reveals how teachers can use instructional strategies and assessment methods to incorporate the learning styles of the learners in their classes (Gardner, 2004; Kornhaber, Fieros, & Veenema, 2004; Morgan, 1997; Sheahan, 2005; Splitter & Sharp, 1995).

The theory of distributed cognition proposes that intelligence is not a single entity but can be an interrelationship or network of resources that an individual uses to solve problems and generate new ideas. This moves beyond the notion that intelligence is a measurable entity contained within the head of an individual. The concept of distributed cognition supports the view that intelligence is an interaction between the innate abilities of individuals and the cultural environment. This includes learning-thinking tools, for example computers, PDA`s, MP3 players, paper and pens. It also encompasses references and stored notes in written or digital form. The network of people who can be accessed by the individual either directly or using technology adds to the functional collective intelligence of the individual (Resnick, Levine, & Teasley, 1991). An implication of this theory for educators could be that, by utilising technology efficiently and by giving the learners the skills and the tools to harness technology, we can increase the individuals` distributed cognitive network. This can have positive implications for the intellectual performance of the individual.

The rationale behind the use of video papers and the selection of the Lessonlab online learning platform

A number of factors were considered in the design phases of this unit of work. The target group was predominantly Generation Y learners. Their specific learning needs and styles were incorporated into the instructional design. The unit of work contained a large amount of abstract theory, which students struggle to link to practice. The unit needed to seamlessly integrate technology as a platform for learning and as an interactive tool for demonstrating learning. All learning materials needed to be available twenty-four hours a day, both on and off campus. To appeal to a group of visual learners, the materials needed to have a bright attractive look and feel, incorporating pictures, graphics and authentic video footage. This prompted the use of a learning content management system (LCMS), which could incorporate video papers and learning activities. These LCMS use digital servers to store learning materials allowing the separation of the activities and the resources (Oliver, 2001).

A video paper combines research through the provision of active web-links connecting to academic journals, theoretical papers and authentic video footage incorporating a range of interactive tasks. Video papers have been described by Olivero et al. (2004) as a new form of publication, which encourage the combination of the roles of researchers, teachers and learners as both knowledge generators and knowledge translators. By reconceptualsing our pedagogy to incorporate video papers, we are responding to the changing learning needs of students who learn in new and different ways and prefer to be actively involved in their own knowledge construction.

The author investigated a range of methods of presenting the learning materials; ultimately the Lessonlab online learning platform met the instructional requirements for this unit of work. Lessonlab is an online learning platform that consists of a number of "lessons and "tasks" or "video papers" (Olivero, John, & Sutherland, 2004). The Lessonlab platform incorporates a range of video analysis tools so that participants can demonstrate their transfer of knowledge by marking points in the video and writing their own analysis or commentary. The platform encourages participation in an online learning community. All participants can view the video and be exposed to the same learning experience. They can go to the online portal and post their responses. These responses can be shared and commented on by participating learners and teachers through the learning groups on the portal. Access to the portal and specific groups are password protected so can only be used by those engaged in the learning experience. The use of video papers and online forums allow participants to be actively involved in a dynamic learning experience that evolves according to the needs and interests of the group. A key element of the video papers used in this unit was the use of authentic video case studies.

The use of video case studies

The literature was researched to find indicators and key features to include in the development of these video case studies. The method of utilising video to promote authentic learning is widespread in teaching. An example of recent good practice is in the Timm`s study (Steigler & Hiebert, 1999). As a part of the design of the unit of work in this study, exemplary teachers in local schools were filmed as part of the project. Principles of good practice were followed when using video case studies. For example strict ethical procedures were followed, such as obtaining signed consent from all participants and the parents or guardians, of minors. Particular care was taken when using video case studies in an online environment, as aspects of clarity and stability of the image are crucial when the video is to be viewed in a small screen within a larger web-page (Lessonlab-Inc., 2000). A professional filming crew was used to produce high quality footage. The video footage was digitised using VPrism Software. VPrism software allows the viewing of both the video and the digitised text track, which is time linked to the video footage (Clarke, 2002).

The rationale for the use of digital video analysis

A dilemma faced by educators is how to integrate theory and practice. Traditionally there has been an invisible line dividing the theoretical component of courses of study and real life practice. This gap has been particularly evident in courses no curriculum studies and educational theory. The rationale behind using digital video in these courses for teacher educators is to juxtapose theory and reality by combining the visual image of a real teacher in a classroom and the theoretical constructs underpinning teaching practice (Olivero et al., 2004). Video has a long history of being incorporated into teacher education programmes with varying degrees of success (Perry & Talley, 2001). The use of video as purely a visual representation has certain limitations from an educational perspective. When the participant is required to passively view a selection of video, their active involvement and learning is limited. This use of digital video analysis allows the manipulation of video footage by the learner in the online platform. The learners insert marker points and commentaries to indicate their understanding and application of theoretical constructs.

The advances in technology that allow this digital video footage to be housed on a web-based portal and streamed on demand, allow for more active involvement of the learner (Steigler & Hiebert, 1999). In the Lessonlab platform the viewer has a great deal of control over his or her own learning. The viewer can decide when she wants to view the video, which section of video she wants to view, how often she needs to view the video to suit her own learning style. The viewer decides if she needs to see the text track with the visual image and the sound track, or if she prefers to just sight the text track. The learner can adapt the learning experience, to her own specific learning needs and preferences. The advances in digital technology provide a flexible learning environment to accommodate differences in learning style, tempo and modality.

Another advantage of this use of digital video analysis is that the learner selects the sections of video to view and inserts marker points which link to an analysis that he has constructed. This gives the learner ultimate control and allows him to demonstrate that he has reached a point of knowledge transfer or bridging by linking the theory to practice. This platform has taken the control of the learning experience from the educator and placed it in the hands of the learner who can customise his learning experience to meet his pedagogical needs. This transforms the learning journey from one that is teacher controlled to one that is controlled by the individual learner.

Methodology used in the research

A combination of qualitative and quantitative research was used in this study. All the participants in one cohort of the course being described completed a questionnaire comprising 35 questions. The questionnaire gathered quantitative and qualitative data. The items collecting quantitative data used Likert Scales on the demographics of the group, information about their learning style, and ways in which the use of digital technology supported their learning style. A focus group was held with a group of six student volunteers from the first year preservice teacher cohort who participated in the course.

Discussion of the quantitative findings of this study

In these questions students commented on how they liked the flexibility of the course, in that they could complete the online components in their own time. The students enjoyed the range of contents of the course and the variety of the online activities. They felt it made them think and take responsibility for their own learning. They found the video clips interesting and relevant. Some students commented that doing the online tasks took too much time in relation to the percentage of marks allocated to the task. A general trend was that the Generation Y learners enjoyed learning using digital technology yet the few mature-aged students found the use of the online environment more stressful. Generally the mature-aged students made more use of the additional face-to-face support workshops offered and progressed well in the course.

Discussion of the qualitative findings of this study

The information collected in the focus group was analysed for trends and frequencies of specific words and phrases. The general consensus from these students was that they enjoyed using the interface. They enjoyed the bright look and feel of the portal and the inclusion of graphics and animations. They liked the flexibility that allowed them to access the materials at any time from a variety of venues. The main difficulties were concerned with access to technology. The students suggested that more training in navigating the web-based platform could be given at the beginning of the course. The students felt they needed more support by teaching staff during tutorial sessions and access to computers during their tutorial sessions. This would reduce the high cognitive load some students experienced when working in a web-based format for the first time. One student commented that it was the most difficult and challenging of the first year units that she had undertaken but that she enjoyed it as it was stimulating and challenging.

Limitations of the study

A limitation of this study was that the research was only conducted with one cohort of the students approximately 80 % of the one cohort completed and returned their questionnaires (N: 65). The demographics of this group were skewed being approximately 85% female. Thus these results may not be readily generalisable to the broader population yet are fairly representative of the population of early childhood preservice teachers involved in this part of the study.

Problems encountered when implementing this project

This first problem was the inexperience of the teaching team with the digital learning platform. None of the teaching team had used this particular web-based platform before, as it was the first time it was being used in Australia. They had used other web-based platforms, for example the Blackboard online platform. The second and most significant problem was that of a lack of access to technology for the student participants. Many of the students did not have broadband internet access at home. In order to stream the online video content broadband or ADSL was needed. This learning platform was designed in the US where the majority of university students have access to ADSL technology.

The initial premise was that students would be able to access Lessonlab at the mega labs. The mega labs are large facilities, which provide computers for students on campus. They are maintained by the Universities Central Information Technology Services. However, shortly after this unit was started problems arose. It appeared that The Central Information Technology Services could not provide the technical support needed in order to run this web-based system. Lessonlab required changes to the security settings to allow the use of pop-up windows. Lessonlab also required a version of QuickTime currently not installed as part of the standard operating system by IT central. In order to make the changes required to run this system, IT central requested large sums of money, which were not in our budget. This meant that students could not use the Mega labs to do the work required by this unit.

The Computers that were configured to run the system were only in two computer laboratories on the campus. These rooms were also used to teach general tutorials, many of which did not require computers and were generally booked for the whole semester. Therefore students were only able to access these computers after hours or if a group that had booked the computer labs were not using the labs for any reason. This caused much anxiety and frustration from the students.

A solution was developed redress the problem of access to technology. The participants were provided with a computer disc containing the video files, which allowed students who had dial up Internet access to stream the video component from the CD. The CDs` also ran diagnostic tests to check the system requirements of the students` computers and help them to download the necessary software needed to run the system. A problem encountered was that it took a long time to get the CDs made, so students only received these fairly late in the course. These CDs will be available for use in the future teaching of this unit. An online help site was developed to answer student queries.

The analysis of online help site messages for participants in the courses

During the first semester that the Lessonlab platform was used, a help link was included on the site; it logged 700 messages during this time period (from all the units using Lessonlab during the semester). There were approximately 850 students logged on to Lessonlab during the semester, some of these using the platform in more than one unit. According to the analysis of help messages, the majority were referring to students who had forgotten their login codes or who had entered the incorrect login code. Many of these messages dealt with frustration due to a lack of access to the technology.

It is interesting to note that when the same unit was repeated in the following semester only 16 messages were received on the help line and only four requests for help by the unit co-ordinator. The units are now being offered for a third semester so it will be interesting to see if this trend continues.

An analysis of the Lessonlab platform by the coordinator of the teaching team

The Unit Coordinator reported that much of the stress for students could be minimised if students were given access to computers during their tutorial session and were able to negotiate

the platform with the support of their tutors. There were many positive learning outcomes for the course participants: participants gained many useful ICT related skills, which will be beneficial in other courses of study. Many of the participants, particularly some of the females came in with very low levels of IT skills. Additional Lessonlab help workshops were run for those students, which helped improve their general confidence levels in the area of technology. The work produced by the first year cohort was of a particularly high standard. The tasks where they viewed videos of class teaching and had to compare and analyse teaching styles, had them working at a level not normally found in first year students. They were able to link the abstract theory with authentic examples of classroom practice and comment knowledgably on the instructional strategies utilised. This high level of reflection and reconstruction is not typically seem in the work of students who have only been at University for one semester.

The staff teaching the unit reported that their own ICT skills improved while working on this unit. The overall report by the teaching team was that despite the initial difficulties faced in the implementation of this new technology the learning benefits for the students were immense. However, improvement is needed in the delivery, access to technology and levels of support to students.

Implications of this project for educators

Although this paper describes an application of this technology for preservice teachers, it can be used in a range of educational settings. It could be used as an online learning tool for teaching a range of topics, when the inclusion of video or visually based materials would be beneficial. It could also be used for self-appraisal of live performances in drama or the arts or for self-reflection of professional practice for teachers. This platform could facilitate the development of online professional portfolios with annotated video footage and self-reflection.

Conclusions

In this era of rapid technological innovation the use of digital video in an online format can become a very effective teaching tool. The newest MP3 players have the facility to store and play video footage and the new generation of mobile phone and wireless devices can stream video. As educators we have a range of new instructional opportunities available to include in our teaching. The challenge to us all is how can we exploit these advances to benefit our learners and meet demands of learning and thinking in a digital age?

Acknowledgements

As unit co-ordinator and site builder I would like to thank the following who helped and supported me in this project. Professor Max Angus, Head of School, Associate Professor Paul Newhouse, Dr. Graeme Lock, Dr. Chris Brook, Claire Brown, Dr. Hilary Hollingsworth, the ECU IT support staff Ryan Beaton, Danny Etude, Alistair Campbell and my teaching team who bravely followed me into uncharted waters.

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4.13 Reflecting on Teaching Practices using Digital Video Representation in Teacher Education

Due to the high levels of interest shown in the previous paper on the use of digital video analysis I collaborated with two colleagues Dr Paul Newhouse and Claire Brown and wrote another paper based on the research in phase 2 with preservice teachers. This paper was published in a peer –reviewed journal The Australian Journal of Teacher Education in August 2007.

Abstract: This paper reports on the perceptions of teacher education students of the value of using digital tools to analys video-based information on the practice of teachers in classrooms. This strategy was employed to address a dilemma in providing sufficient exposure to real examples of good classroom teaching to link theory with practice. The use of video of teachers in action could augment their practicum experience in schools but this required efficient and effective access to appropriate video material. For this purpose, the use of digital tools in a system called LessonLab was successfully Implemented in an introductory unit focused on learning theories at Edith Cowan University. Data collected using a survey of students and focus group discussion indicated that for almost all the students the experience was valued and the system operated effectively.

Introduction

Recent reviews of teacher education in Australia suggest a failure of courses to link theory with practice and to provide sufficient practical teaching experience (Buckingham, 2005, p. 3). The theory-practice divide is a consistent theme in teacher education in international literature (Schön, 1987; Smith, 2000; Stigler & Hiebert, 1999).

Many educators such as Richert (2005), Schön (1987), Korthagen and Kessels (1999) and Loughran (2002) emphasize the critical role of learning through reflective practice in developing teaching capabilities. She points out that while learning from one's own practice is well understood; learning from the practice of others has had little recent attention. In her case, she has augmented physical observations of classrooms

with the use of web-based materials.

Providing pre-service teachers with adequate opportunities to learn from practice, particularly the practice of others, is a difficult issue faced by the School of Education at Edith Cowan University in Perth, Western Australia, being one of the largest providers of pre-service teacher education in Australia. While it may be valuable to provide more opportunities for students to work in schools and observe more teachers in schools (Korthagen, 2001; Smedley, 2001) this was not possible in Western Australia. With over 4000 students, given the limited number of school practicum placements available, it has been difficult to even place all students in schools for the mandatory practicum periods let alone for additional experience. The limitations on access for pre-service teachers to real classrooms in schools meant that it was not possible to expose them to real examples of the range of particular types of teaching practices that would be desirable, as for example suggested by Louden and Wallace (1996) in their discussion of case-based learning. Without providing enough such experience the pre-service teacher education programme risked becoming increasingly irrelevant as argued by Smith (2000).

The reflective use of digital video in teacher education programmes has been suggested as a way to bridge the perceived gap between theory and practice and augment the opportunities to observe and interact in 'real' classrooms (Bencze, Hewitt, Pedretti, Vaillancourt, & Yoon, 2003). Although not referring specifically to preservice teachers, the argument for this strategy is made succinctly by Louden, Rohl, Barratt-Pugh, Caroline, Brown, Cairney, Elderfield, House, Meiers, Rivalland, and Rowe (2005).

> Our results suggest that it would be helpful to provide beginning and in-service teachers with the opportunity to carefully observe and reflect on the complexity of the work done by effective teachers in their classrooms. This might be done by reviewing videos of effective teachers and discussing their practices with collaborative partners or by videoing themselves as they teach and then reflecting on their teaching .... (p. 237-238)

The evolution of video-based case study analysis has its roots in the theory of reflective practice and case methodology. Schön (1987) referred to the use of video for reflective practice analysis and predicted the potential of computer-based systems to enhance reflective practice. Some years later Perry and Talley (2001) noted that case methodology had become,

> … a powerful tool for bringing the complexities of the classroom into focus and supporting preservice teachers in connecting knowledge and practice. In 1992, Shulman recommended case methodology as an effective tool to create a bridge between principle and practice in an "engaging, more demanding, more intellectually exciting and stimulating" way. (p. 26)

Case study methodology also draws on Situated Cognition theory with its focus on open-ended, ill-defined tasks that present no 'right' answers, but which require the student to view a case study from several perspectives over time and explore competing solutions (Herrington & Oliver, 1995). Perry and Talley (2001) note that,

> Drawing from situated cognition theory, the experts recommended situating the video case studies in real-world classroom experiences and events—authentic activities. This is in accordance with Lave and Wenger (1991), who believed that learning must be "situated in the lives of persons and in the culture that makes it possible". (p. 34)

The benefits of video in a teaching context are numerous and have been well documented. Video provides a natural medium for enhancing the sense of context and realism in case studies. It can capture the complexity of classroom interactions and allow students to replay events and thus see important features that escaped them on first viewing. It provides vast amounts of rich detail using images and sounds that capture the immediacy of a real classroom that all students can draw upon as common examples of authentic learning experiences (Jacobs, Kawanaka, & Stigler, 1999; LeFevre, 2004; Perry & Talley, 2001; Stigler & Hiebert, 1999). However, as LeFevre (2004) cautions,

> The problem that is often overlooked is that video of itself is not a curriculum….Video is rather a medium which can be developed into a resource and used in specific ways to enhance learning. Video can become a part of a curriculum for learning if it is designed to be used in intentional ways towards intentional learning goals. (p. 235)

Pre-service teacher educators have long used video examples of authentic classrooms and teaching to supplement lectures and provide more exposure to 'real' teachers in the act teaching (Fuller & Manning, 1973). One of the authors was required

to analyse videos of his teaching as part of pre-service teacher education in 1978. However, the expense and complexities of the technologies required to use analogue video (e.g. multiple microphones, two cameras and operators and wires stretching across the room) meant that it was not feasible to provide all students with adequate access. Therefore, the author was only required to analyse two videotapes with only one in a real classroom. Digital (computer) tools should now provide more cost effective and ready access to video analysis as explained by Jacobs, Kawanaka and Stigler (1999).

> However new computer software ... allows users to instantaneously access any part of the video simply by clicking on the appropriate part of the videotape or transcript. Certainly, at the present time many of the technical limitations of videotapes have been overcome and video data is easier to store and analyze than ever before. (p. 720)

It is unlikely that merely viewing a video of a teacher and class in action will lead to significant impact on teaching capability. The video needs to be embedded within a process of inquiry about practice based on sound instructional approaches (Richert, 2005). In Richert's case students used a browser to access video, text and graphics associated with the practice of two teachers that included the teachers' own reflections on practice. These materials were referred to as "multi-layered records of practice" (p.301) with students guided through an inquiry of them using a process based on the work of McDonald (1992). This approach supported students in linking the case studies of practice with theory of teaching and learning and ultimately influencing their own teaching capability. Clearly students need appropriate scaffolding and tools to adequately analyse rich digital media based case studies to become valuable learning experiences.

The Third International Mathematics and Science Study (TIMSS), now referred to as Trends in International Mathematics and Science Study, provided the impetus to develop the use of teacher video case studies to greater sophistication because "for the first time, we could see what teaching actually looks like on a national scale" (Stigler & Hiebert, 1999, pp. ix-x). It also led to the development of an Information and Communication Technologies (ICT) platform, called LessonLab, that allows online video analysis of classroom teaching activities. Lessonlab has evolved into a full learning management system but at its heart lies a tool that allows both the lecturer and the student to digitally mark the video to time signatures to identify significant

moments. This sets it apart from other learning management systems. The use of such a tool may enrich students' learning experiences by supporting a redistribution of power away from the lecturer in making choices about which part of videos to view and analyse. In the traditional model that power has rested with the lecturer, but LessonLab redistributes that power to the students thereby making the learning opportunities for them far richer. Unlike the more traditional use of video where a lecturer simply shows a video excerpt, this platform features an inbuilt tool that allows both the lecturer and the student to mark the video to identify significant moments of teaching practice.

Using Digital Video to Reconceptualise Teacher Education

From 2003 the LessonLab platform has been increasingly used to support teacher education courses at Edith Cowan University in Perth, Western Australia. The aim has been to incorporate the use of the platform in reconceptualising teacher education courses towards more learner-centered pedagogies that support students in relating theory to practice through analysing authentic teaching examples. This paper reports on research conducted in 2005 with one first year education unit of study that incorporated the use of the LessonLab platform. The research addressed the question of whether incorporating the analysis of digital video of teachers in classrooms would assist students in linking theory to practice.

The Students and the Unit

The twelve-week unit titled, Becoming a More Effective Learner, was taken by teacher education students at the beginning of a Bachelor of Education programme in Primary and Early Childhood education. The unit included a weekly face-to-face 1-hour lecture and 2-hour tutorial and was formally assessed. In 2005 there were 365 students of whom approximately 85% were female with about the same proportion falling into the 18-25 year old age range. This put them into Generation Y, the first generation to grow up with computers in their homes and schools and generally regarded as being accustomed to using technology for communication, information and recreation and being very visually orientated learners (Marsh, 2004). However, research has also suggested that some female students can lack confidence when using technology (Cassell, 1998) and thus the study had to be mindful of highly confident and under-confident students.

The intention was to provide an online learning resource designed to appeal to these learners as part of a blended pedagogical approach using face-to-face lectures and tutorials and independent online work. The overall brief was to take the traditional textbased face-to-face course and reconceptualize the pedagogy to include the social

constructivist principles of learning and an increased use of technology (Dalgarno, 2001). It was assumed that most of these learners already interacted well with technology and would respond positively to a digital audio-visual interface incorporating graphics, web links, animated graphics, and digital video of 'real' teachers in action in 'real' classrooms. The latter is the focus of this paper with the use of the LessonLab platform to provide access to the video material and tools to analyse and reflect upon the content of this material.

LessonLab as a Learning Management System

Various web based learning management systems were considered such as Blackboard™ that has been used widely in the University. Blackboard offers very little to support the use of digital video and therefore alternatives were considered that included the modeling of a system to house the video on a separate server and have links to the University's Blackboard system. However, this proved to be clumsy and inflexible. For the purposes of this course a more flexible system was needed, one that could easily be modified by the instructors in response to the students' learning needs. LessonLab was chosen as the learning management system because it offered the required digital video tools as well as an appropriate look and feel and a full range of features typically found in a learning management system such as the uploading of documents, bulletin boards, email, student registration and tools to support assessment processes. LessonLab web pages are written in html coding that allows for the inclusions of graphics and animated GIFs. The platform includes "lessons" and "tasks", interactive activities the designer can build in various formats. They can be created with various options, one is to allow students to view other student's submissions once their work has been posted thus enriching the learning experiences for the students. Another feature is the collation of data from online surveys with the data displayed in graphical forms allowing comparisons between groups and analysis to be presented to the students to facilitate discussions. Critically, LessonLab contains a range of options for the incorporation of digital video footage.

Creating the Video Case Studies

Teachers in local schools - whose pedagogy was identified by specialist academic staff as including social constructivist practices relevant to the course - were filmed teaching a class. To provide examples of authentic classroom teaching more than 100 hours of unscripted entire lessons were filmed under normal school conditions. A professional filming crew was hired to ensure the high quality footage needed to adhere to good practice in developing video case studies, in particular the clarity and stability

of the image, and a high quality of sound (LessonLab-Inc., 2000; Perry & Talley, 2001). This film was digitised using v-Prism Software that allows the viewing of both the video and the digitised text track, time linked to the video footage (Clarke, 2002). The videos were made available to the unit coordinator on CD-ROMs with about four lessons on each disc. Selections made by the unit coordinator were included as online video analysis tasks that showed how teachers were accommodating the learning styles and needs of the learners in a range of subject areas in a range of educational settings with early childhood, primary and special needs classes. This allowed the students a degree of choice with access to six hours of video on CD-ROM including some complete lessons and shorter exerts of approximately 10 to15 minutes from each class linked to the video analysis tasks.

The video case studies were designed around interactive activities that included "lessons" (the videos), "tasks" and "forums". The video was embedded within learning sequences requiring students to view input from the instructor, insert digital markers in the video (time-coded tags), attach text-based comments to those markers, and view the comments posted by other students. The comments resulted from their reflective analysis of the teaching at that specific part of the video extract with encouragement given to use academic references to support the analysis. The online survey tool was also used for students to communicate their judgments with the resulting data displayed in graphical form allowing students to analyse and discuss the results. The use of the LessonLab tools changed the learning activities from that of viewing the video to actively participating and demonstrating a transfer or application of theoretical constructs to the teaching scenario. Two weeks of face-to-face instruction were cancelled to allow students more time to work independently online on the video analysis for assessment by tutors. The tutors assisted the students in familiarising themselves with the platform and were available online to give help and support when requested in addition to the online help desk.

Research Methodology

A case study qualitative evaluation research design was employed to investigate the success in using video analysis through LessonLab in reconceptualising the unit of study and to investigate the perceptions of students in the use of the video materials. This paper reports on one aspect of the overall study related to the research question: To what extent can the video analysis tools in LessonLab be used to support pre-service teachers in relating theory to practice through reflecting on the practice of teachers? The online materials were trialed with a cohort of students in Semester 1 and then

fully implemented with a second cohort in Semester 2, 2005. There were 85 students in this second cohort with one of the authors as the coordinator and lead lecturer. Data were collected at the end of the semester from these students using a questionnaire to survey all students and a small focus group interview of 12 randomly selected students. The research question was addressed by evaluating the level of success in using the digital video delivered through LessonLab through analysis of some student survey items and gaining a more in depth insight into the use and impact of the learning strategy through analysis of a focus group discussion.

The questionnaire was developed by one of the authors with items validated through peer and expert review, including review by a University ethics committee. There were basic demographic items, four open-ended items associated with learning style and response to the unit, and 36 Likert scale response items. Items related to the research question reported here were six of these latter items associated with the use of technology to support learning and four items associated with the perceived learning value of the unit. These two sets of items were used to generate two scales, Technology for Learning and Value of Unit that were used to address the research question.

The Technology for Learning scale combined the following survey items.

Item 27: I enjoyed using technology for learning and research.

Item 28: The technology used required interaction and active participation.

Item 29: I currently own or use technology for recreation for a few hours a week.

Item 30: I avoid using technology where possible. (Reverse item)

Item 31: I am confidently able to use technology to support my learning.

Item 32: I prefer not to use technology to support my learning. (Reverse item)

The Value of Unit scale combined the following survey items.

Item 33: Knowledge of learning theories helped me to understand my own learning style and needs.

Item 34: This unit helped me understand the diverse learning needs of children that I teach or will teach in the future.

Item 35: This unit made me aware of a range of strategies to help me learn more effectively.

Item 36: I would recommend this unit to other students.

The items comprising these two scales were coded using integers from 1 to 5 to indicate a positive response towards the unit and using technology for learning. The data from these items were imported into SPSS to generate descriptive statistics and to calculate scale values. In addition to descriptive statistics for these two scales,

statistical tests for correlation were conducted against two other questionnaire items. Further analysis was conducted by considering responses to two other items.
Item 23: The use of authentic classroom video footage suited my learning style.
Item 24: The constant availability of a range of online learning resources supported my learning.
This included using t-tests for differences in means on the two scales between those who were negative and those who provided positive responses to each item. Finally analysis was conducted on the responses of a small group of students who indicated in Item 32 that they preferred not to use technology to support their learning, in particular looking for consistency of responses by these students to the other items.
An independent researcher conducted the focus group with three leading questions, constructed by the course coordinator, used to focus on the extent to which the learning outcomes of the course had been met. However, the discussion was encouraged to extend beyond these questions. The discussion was recorded using a digital audio recording device with the responses summarised onto a spreadsheet. The researcher then collated the responses around common themes that emerged. This process was then validated by the course coordinator who was not involved in the study. The data were then analysed further by the researchers with a focus on themes that related to the research question addressed in this paper.
Before presenting the results of the study the limitation of having one of the researchers as a lecturer in the course needs to be considered. This participatory role meant that care needed to be taken in collecting and analysing the data to ensure students were not influenced by the role of the researcher and that this researcher's desire for the success of the strategy did not bias the analysis. Firstly, this researcher was not the coordinator of the course and thus the course coordinator could be used to validate some of the interpretation of the results. Secondly, data integrity was maintained by using anonymous questionnaires and by another researcher, who was not involved in delivering the course, facilitating the focus group. Finally, the data analysis was conducted by the two researchers who were not involved in delivering the course. As a result of these measures the influence of the researcher as a participant was minimised.

Discussion of Results

This paper reports on the analysis of the data directly related to the research question concerning the use of Lessonlab to provide video analysis of teacher practices. From the unit coordinator's point of view, the LessonLab platform was successfully

implemented with all students able to access all the online materials, in particular the digital video materials, and able to interact with the video to analyse teacher practices. There were only four requests for help logged with all being responded to within a few days.

Final Questionnaire Results

At the end of the semester students completed a voluntary questionnaire. There were 68 returns on the questionnaire that represented a return rate of 80%. Only 6% of these indicated being male, 60% indicated being between 17 and 24 years of age and only 4% indicated a non-English speaking background. Both scales were found to have high reliability for these data with Alpha reliability coefficients of 0.91 and 0.94 respectively on the Technology for Learning and Value of Unit scales. The distributions of scores on these scales are shown in histograms in Figures 1 and 2. The means and standard deviations for the scales are provided in Table 1. The results clearly represent an overall positive attitude among these students towards both the unit and using technology for learning. In fact there were only three students with a Value of Unit scale ('unit') value below the midpoint of 3 and only five with a Technology for Learning scale ('techln') value below the midpoint. It was therefore not surprising that there was a significant, although only moderate, correlation between the scales ($r = 0.54$, $p<0.01$).

Scale Items Min. Max. Mean SD Alpha Reliability

Scale	Items	Min.	Max.	Mean	SD	Alpha Reliability
Technology for Learning	6	1	5	3.9	0.7	0.91
Value of Unit	4	1	5	4.1	0.8	0.94

Table 1: Results for two scales constructed from items from the questionnaire.

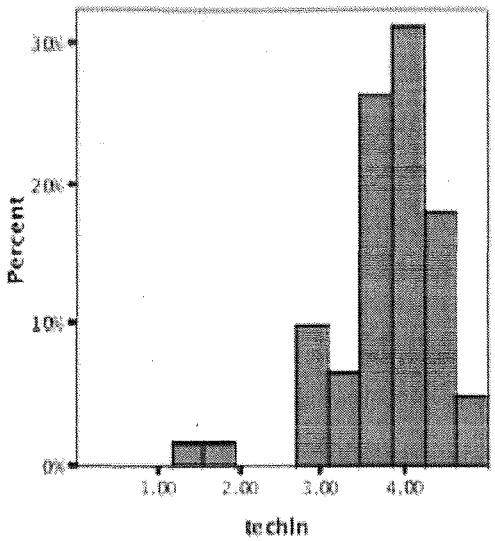

Figure 1: Histogram showing the distribution of scores for the 'Technology for Learning' scale.

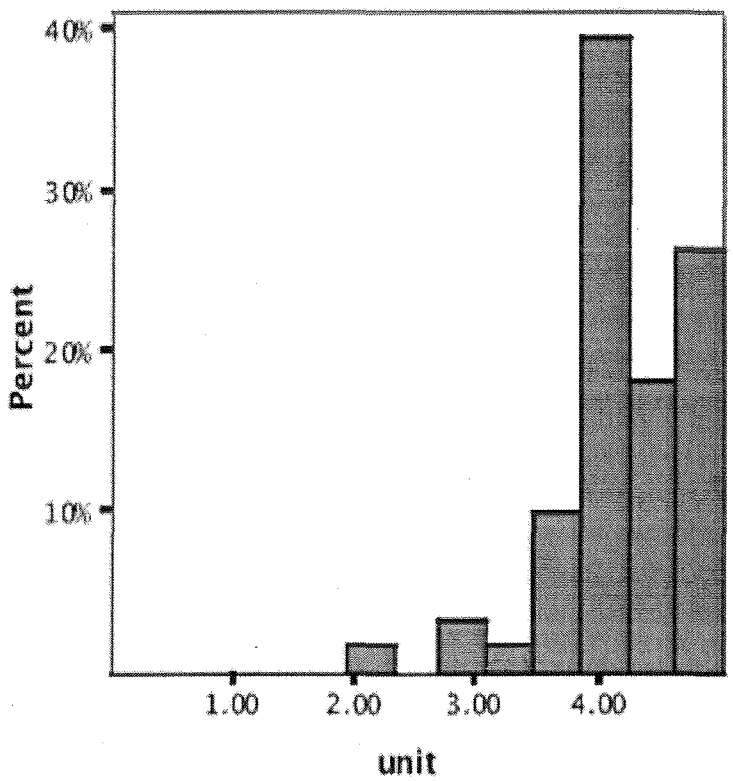

Figure 2: Histogram showing the distribution of scores for the 'Value of Unit' scale.

To further analyse the results for the two scales various groups of students were identified and then tests conducted to determine any differences in means for the groups on the two scales. One item (23) asked students to indicate the extent to which they perceived that "the use of authentic classroom video footage suited" their "learning style". Overall 54% indicated agreement, 22% were neutral and 13% were negative. A t-test indicated no significant difference in mean for either scales between those who were positive and those who were negative.

Another item (24) asked students to indicate the extent to which they perceived that "the constant availability of a range of online learning resources supported" their "learning". Overall 59% indicated agreement, 18% were neutral and 12% were negative. A t-test indicated no significant difference in mean for either scale between those who were positive and those who were negative.

There were 10 students who indicated that they did not want to use technology to support their learning. Surprisingly, it was not found that these students were also negative with the other items in Technology for Learning scale, however, five of them did respond negatively towards both items 23 (use of video) and 24 (availability of online resources). It is likely that this is the usual group of about 5% of students who are found to be opposed to using computers to support learning. Further, one student responded negatively towards Item 23 and five of the six items of the scale. This student wrote the following in one of the open-ended items.

Lesson lab (sic) can hinder learning experience to a motivated &
enthusiastic learner due to difficulties experienced with getting it to work.
Enthusiastic lecturers.

This student liked the unit but mainly because of the enthusiasm of the lecturer and had technical difficulties with the LessonLab platform that had turned her off using technology to support learning. However, fortunately her experience was not that of the vast majority of the other students. Only five other students specifically wrote that they did not like using LessonLab and none of these indicated general negativity towards using technology to support learning.

Focus Group Results

One of the authors, not an instructor in the unit, conducted a focus group with 12 of the students. There was much positive affirmation for the course and no criticisms expressed. One mature age student said that, "The course exceeded my expectations. I was amazed at the breadth of resources available". Comments about ICT in general

indicated that they had developed skills beyond their previous experience with comments such as the following. Would have preferred this unit in 1st Semester as I was computer illiterate! Learned a lot in this unit - very useful. It was hard to do this unit, but I learned so much My computer skills improved a lot! Went from being computer illiterate to a computer nerd!

For the students who were confident with ICT, there was unanimous support for LessonLab. For students who had lacked computer skills the consensus was that the Quicktime video proxy authentication required to negotiate the University's firewall made it difficult to use. Support for being able to use the video in an interactive way was unanimous with comments such as I loved the video and found it to be a great learning advantage once I could use it. I like how you can stop and watch the video many times and go back and forward. You don't feel bad watching the video and making comments online rather than in front of teachers or others. I appreciated the more up-to-date content of these videos compared to other videos shown in other units.

The students overwhelmingly endorsed the continued use of the LessonLab platform and demonstrated through explanations in their responses that the use of the video had improved their ability to make links between theory and classroom practice.

Conclusions

This small-scale study demonstrated the potential of the LessonLab learning management system in providing a good platform for video-based case study analysis for teacher education students, overcoming the critical obstacles identified prior to the use of digital video. Technically, the video-based tools operated well while the other facilities of the platform were readily incorporated within a total learning experience for the students. Only a few students indicated either difficulty using the tools or negative attitudes towards their use despite the fact that most students indicated little previous use of computer systems to support their learning. It is likely that these students will continue to be negative towards the use of technology to support their learning irrespective of measures taken in a course. For almost all the students the experience was valued with the system providing easy access to the video material and opportunities to use digital tools to analyse and reflect on the content.

The use of digital video-based case study analysis clearly provides a good basis around which to reconceptualise teacher education courses and supports students in linking theory with practice. The LessonLab learning management system provides the tools with which this may be accomplished. The blended approach that embedded the use of the online resources and activities through LessonLab within a face-to-face

instruction mode was successful and appreciated by most students. This approach is recommended for the inclusion of the LessonLab system for undergraduate teacher education. The system provides an environment within which appropriate scaffolding and tools can be provided for students to analyse the rich digital media within an inquiry-based approach to learning from the practice of others (Richert, 2005).

The aim of the reconceptualisation of the course was to support students in making more meaningful connections between pedagogic theory and practice. The LessonLab system provided an effective means of providing access to video of authentic teaching examples with tools to analyse and reflect upon the content. While the focus of this paper is not on whether this led to students making more meaningful connections between pedagogic theory and practice, the lecturer and tutors in the unit were convinced that, compared with cohorts in previous years, students demonstrated much better understanding of the pedagogic theory and related this more authentically to their own practice and that of experienced teachers. Data were collected that directly addresses these questions and questions concerning the learning styles of the students that will be reported in later papers. The design and implementation of this digital strategy has been a learning experience for the authors that will continue as the potential for analysing and reflecting on video-based examples of authentic practice is further explored to build more dynamic and effective learning environments. For example, by developing online video based modules to showcase effective teaching practices this would assist preservice teachers make the conceptual link between theories of education, instructional methodologies and what it looks like in real classrooms. This study gives confidence in conducting further research to verify and extend upon the approach.

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4.14 Phase 3 Post-Graduate Diploma Students

Ch 1 Introduction	Ch 2 Lit review	Ch 3 Research Phase1 Teachers	Ch 4 Research Phase 2 Preservice Teachers	Ch 4 Research Phase 3 Post Grad Students	Ch 4 Research Phase 4 Technology in teaching	Ch 5 Future of Teacher Education	Ch 6 Conclusion

Figure 24: Portfolio progress chart chapter 4 phase 3

The research done investigating the learning needs and styles of undergraduate pre-service teacher education students prompted me to question the work I was doing with post- graduate students co-ordinating a graduate diploma course in teacher education. In this course students come from a range of backgrounds. Many of the students are undergoing a mid-life career change, while some have just finished a first degree and are completing the graduate diploma prior to getting their first job. Many of the mature-aged students lacked confident in using technology. I decided to survey the students about their levels of confidence in using technology to see where I needed to provide extra support.

4.14.1 The online survey

I wanted to model different ways of using technology in teaching so I choose to use an online survey. This survey was created using the Filemaker Pro Program. It was designed to integrate with an online student management system, which I used to provide a high level of support for students. This system will be further explained in phase 4 of the portfolio in a section entitled integrating technology in tertiary teaching. The online survey was a voluntary survey, which collected information from students to help the teaching staff focus our teaching to meet the learning needs and styles of the students. The survey gathered data on the students' levels of confidence using different forms of technology and asked them if they needed extra support in any area. Students were also asked for information on their previous qualifications and work experience to see which students had experience using technology.

The online survey was an easy way for me to collect information from students. The students needed to go to a website which housed the survey. They completed the

survey by selecting answers to questions based on a scale of not competent, competent and very competent. They were also asked if they wanted to learn more about any of the applications.

SECTION 2: Information and Communication Technology (ICT)

Please indicate by clicking what your level of compence is in the following applications.

				I would like to learn more about using this application?
Word-process	Not competent	Competent	Very competent	Yes No
PowerPoint	Not competent	Competent	Very competent	Yes No
Xcel	Not competent	Competent	Very competent	Yes No
Email	Not competent	Competent	Very competent	Yes No
Internet	Not competent	Competent	Very competent	Yes No
Library Research skills	Not competent	Competent	Very competent	Yes No
Web Editing	Not competent	Competent	Very competent	Yes No
Use of Digital Camera	Not competent	Competent	Very competent	Yes No
Use of Digital Video Camera	Not competent	Competent	Very competent	Yes No
Digital Media Editing	Not competent	Competent	Very competent	Yes No
Interactive Whiteboard	Not competent	Competent	Very competent	Yes No
Discussion Board	Not competent	Competent	Very competent	

Figure 25. The online survey- technology section

This information which was collected in a digital format was easy to download directly into Excel® and then imported into SPSS® for analysis. This was an efficient way of managing information, as no transcription was needed as all information was seamlessly transferred from one digital format to another with no room for human error when entering data.

4.14.2 The results of the survey

The survey contained quantitative and qualitative questions. The qualitative questions gathered information on the students' previous degrees and work experiences. Information was also collected on any additional skills they had which could be useful for future teaching and practicum placements for example proficiency in another language, first aid certificates and bronze swimming certification. This information was used to inform academic staff about the background levels of content knowledge students had in an area, for example a number of students approximately 10% has masters degrees in psychology, 151 students 50% of the group had some previous

teaching experience while the other 50% of the group had no previous teaching experience.

The quantitative results of the survey were analysed using SPSS. Descriptive statistics were used to determine frequencies. The frequencies were collated in a table to allow easy comparison of data.

Table 10: Student perceptions of their competence at using ICT

	No response	Not competent	Competent	Very Competent
Word	18	11	138	135
E-mail	17	5	109	171
Internet	17	6	121	158
Excel	18	92	138	54
Power Point	20	99	114	69
Digital Camera	17	40	156	89
Web Editing	20	229	42	11
Digital Video	21	114	119	48
Discussion online	20	111	130	41
Research Skills	18	35	181	68
Digital Media	20	221	43	18

As can be seen in the table showing frequencies of students perceptions of their competence at using information and communications technology, ICT, there are large discrepancies in the levels of competence reported by the students in the post –graduate diploma course. A total of three hundred and two students completed this voluntary online survey. These students made up two cohorts of the post-graduate diploma in primary education course in 2006 and 2007. Eleven students reported that they were not competent in using word, 92 students reported they lacked competency in Excel and 99 students, 32% of the group reported that they lacked competency in using PowerPoint. The basic applications Word, Excel and PowerPoint, are frequently used

by teachers and there is an expectation that all teachers should be confident in using these applications in their teaching.

There were however numbers of students who felt they were very competent in using these basic applications, with 44% of the group feeling very competent in their use of Word and 56% feeling very competent in their use of the internet, while only 5% of the group felt very competent in their use of digital media. When questioned about their skills in more challenging applications the number of students who felt they were not competent increased with 73% of the students not feeling competent in the use of digital media, 75% of the students not feeling competent in doing web editing, 36% of the group not feeling competent to use online discussion boards.

When asked whether they would like to learn more about using an application many of the students expressed a need for further learning and support, for example 113 students or 37% of the group requested further learning about Word, 168 students or 53% of the group requested further learning about PowerPoint. The number of students wanting to learn more about ICT applications can be seen in the table 10 titled "Student requests for further learning in the use of ICT". It is interesting to note that while only 11 students reported they were not competent in using word, 113 students wanted to learn more about using Word. This indicates that some of the students who rated themselves as competent users of the application recognised that there were still things that they wanted to learn about using that application.

Table 11: Students requests for further learning in the use of ICT

	No response	**No PD**	**Yes I need PD**
Word	125	64	113
E-mail	135	92	75
Excel	106	36	160
Power Point	100	39	163
Web Editing	79	28	195
Digital Camera	110	50	142
Digital Video	87	39	176
Digital Media	82	28	192
Research skills	105	42	155

These results indicating that many students lacked competence in using very basic applications and that many of the competent students wanted to improve their skills in using technology led to changes in the design of the course so that tasks were redesigned to integrate more use of technology. These new tasks were designed as group tasks so that the more skilled members of the group could help those students who were less competent in using technology. Each group of students had to compete a team assessment rubric for the task in which they were asked if all members of the group were now competent in using a particular application, for example PowerPoint. In addition a range of online supports including podcasts were developed for the students to give them support to assist them in self-paced flexible learning in areas where they felt less competent. A description of how the podcasts and other technologies were integrated into my courses to support the learning styles and needs of tertiary students has been included in the following section of the portfolio.

4.15 Phase 4 Integrating technology in tertiary teaching

Ch 1 Introduction	Ch 2 Lit review	Ch 3 Research Phase1 Teachers	Ch 4 Research Phase 2 Preservice Teachers	Ch 4 Research Phase 3 Post Grad Students	Ch 4 Research Phase 4 Technology in teaching	Ch 5 Future of Teacher Education	Ch 6 Conclusion

Figure 26: Portfolio progress chart chapter 4 phase 4

The data obtained from this survey and from discussions with students revealed a number of common learning needs of the post-graduate students. A main finding was that there are vast differences in levels of skill and content knowledge in the cohort. The students generally needed flexible learning materials that they could use at the time of need. This prompted me to use a number of different technology based applications to support the student learning. In this way teaching staff could model a range of uses of technologies to the students encouraging them to integrate technology in authentic ways in their teaching. We could also provide "just in time" support for the students with such a wide range of learning needs. The details of how technology was used to support the learning needs and styles of these post-graduate students have been provided in the conference papers and a book chapter included in the sections below.

In the first presentation I have included a co-author Alistair Campbell, he is an expert data-base development and he helped to develop the data gathering techniques described in the paper. The design and use of the online survey and the digital data-base was presented at Create World an Apple University Conference 2007 as a paper entitled "Working smarter to improve the learning experience of large student cohorts using an EPSS and Web-2 technologies". I was awarded a scholarship from Apple Computers for this conference presentation. This was a technical "hands on" workshop session. I have included a brief overview of the presentation. In the presentation participants were given runtime versions of an interactive web-based student management system, (SMS). The student management system was designed to assist in managing and communicating with large cohorts of students and academic staff in a tertiary post-graduate program.

A more detailed description of the project will be presented at The Australian Computers in Education Conference in 2008. This paper has been accepted for presentation and has been peer-reviewed. This paper was written in collaboration with Alistair Campbell the technical expert who built the interface.

4.15.1 Australian Computers in Education Conference 2008

The digital filing cabinet: Using web2 technologies to collaborate, create and manage student information.

Abstract

This paper discusses the development and piloting of a digital filing system. It promotes the idea of the paperless office or teaching space of the future. This is a tool to improve efficiency, accountability and collaboration when managing data. This system allows you to have access to all your records wherever you are. It allows joint authoring and input of data. Teachers, managers and students, who need to store and manage important data, can use it. It supports a vision of a learning community of the future where all the needed information is right at your fingertips where ever you are working. Key players can access records over the web at any time or place or as a stand-alone version on the desktop when you are not connected to a network. The system is designed to improve efficiency and effectiveness of staff. This paper documents the process underlying the development of the system in which an ICT specialist and an educator worked collaboratively over two years to trial and pilot the system. The current application is in a tertiary setting managing a course that runs over three campuses. The technology and principles of this interactive web-based student management system can be used in school settings for digital portfolios, managing assessment records or office settings for data management.

Introduction

"Leading edge companies are no longer those who have displaced and controlled labour with technology but those who have found ways of using technology to enhance the value of the labour they employ." (Young, 1998, p141)

Young in his book the curriculum of the future describes how technology can be used in creative ways in a learning society (Young, 1998). This paper describes an action research project in which web2 technologies are utilised to improve the management, learning outcomes and student satisfaction of the Graduate Diploma of Education (Primary) Course (203). This is a complex course to manage, as it spans three campuses with fulltime, part-time and mid-year enrolment options. There are more than ten full

time staff members and double the amount of sessional staff teaching in the course. As it is a one-year post-graduate course, there is only limited time in which to meet the students learning needs. The course caters for between 200-250 post-graduate students distributed over three venues, metro and country, at a University in Perth, Western Australia.

One of the dilemmas facing the academic co-ordinator of this course is that in response to fiscal cut backs in tertiary education and the serious shortage of teachers in Western Australia the student staff ratios in this course have increased dramatically. The Top of the class Report (Commonwealth-Australia, 2007), a comprehensive report commissioned by the federal government into the quality of pre-service teacher education in Australia, discusses the impact of the under funding of teacher eduction courses and suggests it is an area of national priority. (Angus, 2006; Commonwealth-Australia, 2007). The impact of the under funding can be seen in this course which previously ran efficiently on one campus with one academic co-ordinator to approximately sixty-five students for many years. Currently the course has grown to accommodate over 200 students yet is still co-ordinated by one academic. These factors motivated us to teach and work differently initiating a novel project as described below.
The motivation

Faced with the pressures of reduced resources, raised student expectations and market competition to attract and retain students we came to a realisation that we need to work and act differently in order to continue to offer a well-managed course. We needed to " ACT on IcT" working smarter, using technology to make our work more efficient. There are many references in the literature about groups who learn and think differently because of the use and exposure to technology. Prensky, coined the term digital native to describe a group that have been exposed to technology and integrated technology into every aspect of their lives (Prensky, 2004). Appears to be an emerging style of pedagogy incorporating new technologies to cater for digital natives as described by Kenneth Green in his keynote address at the Apple University Consortium Conference in 2007. Green`s research The Campus Community Project, an ongoing study starting in 1990 on the role of ICT in American Higher Education. In this project Green surveyed the academic staff and discovered a small group of educators who are embracing the new technologies, grappling with ways to integrate these technologies to enhance the learning experience of the students. Green called them millennial educators

(Green, 2007). This descriptor fits the type of pedagogy used in this project using technology to suit the teaching and learning styles of the teacher and the students.

This concept of using technology to enhance our learning and thinking styles has been described by Lane and other authors using the term distributed cognition in which intelligence can be an interrelationship or network of resources that an individual uses to solve problems and generate new ideas (Lane, 2007; Nuckolls, 1998). In this paper we build on this idea of distributed cognition using web 2 technologies and harnessing the collective memory of team members and the ICT tools to achieve more than an individual could alone or in a previous paradigm without the technology. These are the realms and exciting possibilities explored by millennial educators. Many of these millennial educators are engaging in cutting edge work using new technologies much of this work goes unrecognised by the traditional structures in which we work (Green, 2007). A further factor motivating the use of ICT was that we wanted to model to our students, pre-service teachers that as faculty we were using technology in innovative ways to enhance the teaching environment. Research is indicating that many pre-service teachers, particularly females, lack confidence in using technology and can benefit by seeing positive role models interacting with technology(Comber, 1997; Lane, 2005b).

The challenge

When managing large groups of students located over three campuses, the course and unit co-ordinator(s) needs to have speedy access to a wide range of data regarding students, to support them through this demanding course. With the transformation of the academic environment into more of a user pays scenario, there are different expectations from the students who see themselves as clients buying a service and view academic staff as service providers(Levin & Belfield, 2003). One of the challenges of teaching in the knowledge society as described by Hargreaves is that education is viewed as a commodity to be bought and sold (Hargreaves, 2003). The students expect a short turn around time and quick follow-up of issues and problems by the course co-ordinator. Another aspect of the knowledge society is that the information and communication technologies can be used to make learning organizations more efficient and competitive in a market based economy (Fitz, 2002; Hargreaves, 2003).

The interplay of these factors led to the collaborative development of this technology-based project. This project was designed to assist educators, course co-ordinators and managers in the complex task of tracking, monitoring and improving the

student experience and to promote good student outcomes through the use of an interactive online electronic paperless support system (EPSS) or digital filing system. The digital filing system collates a range of vital data, including an initial online placement survey, to provide a high quality effective teaching program for large cohorts of postgraduate students. The design of the project will be described in the next section of the paper.

The project design

We decided to replace the individually kept paper-based record systems used by individual staff members with one electronic system. We applied for a teaching and learning grant which funded the software needed for the project and paid for technical support to develop the system. The design criteria were that the system had to be easy to use as some of the team have limited ICT skills. It needed to be secure, pass word protected yet accessible to multiple users over three venues. Users needed to have varying levels of read/write privileges. There needed to be a web-based and a stand-alone machine based version. We embarked on a two-year pilot study using an action research model in which prototypes of the system were designed tested modified and critiqued by the ICT developer and the academic staff. We are now nearing the end of that phase and are ready to extend the system for wider use.

Rationale

The educator or unit co-ordinator needs to have access to student data and progress records so they can maintain standards of quality and accountability within a course. When courses are taught at different venues and at different times, student information/records need to be available to all staff "anytime, anywhere" to promote efficiency. This prompted the incorporation of the interactive capabilities of Web2 online technologies. Filemaker Pro 8.5 provided the development tool for creating the online portal with multiple search facilities. Filemaker was selected because it works seamlessly across both Mac and Pc environments and can be used by novices with no programming experience using the online tutorials. The system can be upgraded to a server-based version as the project grows.

Traditionally the academic staff used paper-based files and note keeping systems for student data. As the course grew from 65 students based on one campus to approximately 250 students on three campuses with large numbers of staff there were problems managing and communicating student information quickly and efficiently to

all stakeholders. The universities database CMS provides read only access and users need to be online to access data. We needed a system that could be accessed both online and offline. The users need to have read only access to core data but also needed to create data by adding file notes, assessment results and records of interviews and telephone conversations with students. We could not find a system with these capabilities within our university so decided to create our own digital filing system based in the form of an electronic, interactive support system.

Using this digital filing system unit co-ordinators and tutors can quickly find student details, such as contact details, add notes and data both at the unit and a course level. They can also access all data and follow up on recommendations to students, particularly where low achieving students are referred for academic support. It has been found that unless these recommendations are followed up the same students repeatedly get these recommendations but seldom seeks out the help needed. Research literature indicates that assessment can be an area of conflict and student dissatisfaction in large units. Access to this type of information can be useful in reducing conflict, such as in student appeals. The tool will provide authentic evidence that cannot be disputed.

When developing any system containing confidential data there are ethical considerations that need to be built into the initial design, such as password protection so only authorised staff members have access. The design incorporated a voluntary online survey to obtain details about the students past experiences to assist in practicum placement. A letter informs them that the information in the survey is to be used for academic purposes only. Students are also required to sign a consent form that allows their photographs to be used for course administration purposes only.

This unit/course level digital filing system will build upon, integrate with, and enhance the existing university based student management system (SMS) called Callista (this is read and online access only). The following two figures show firstly the sources of information and types of access that will be provided (Figure 1) and Figure 2 shows a possible display of the information.

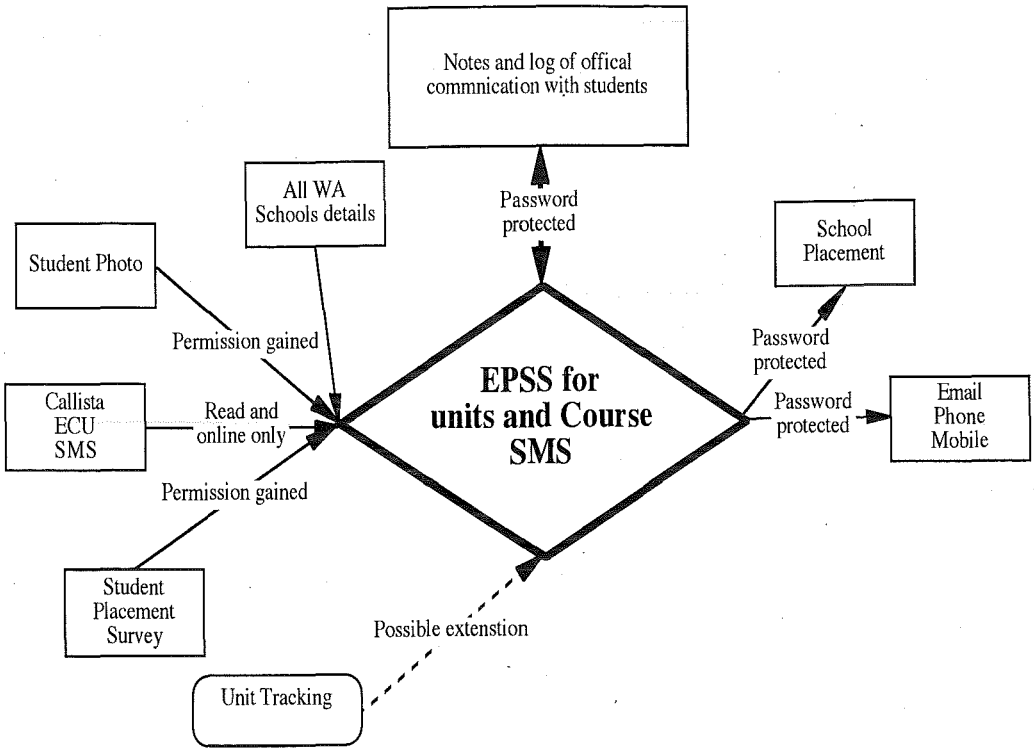

Figure 1: Flow of information in and out of the EPSS Course SMS

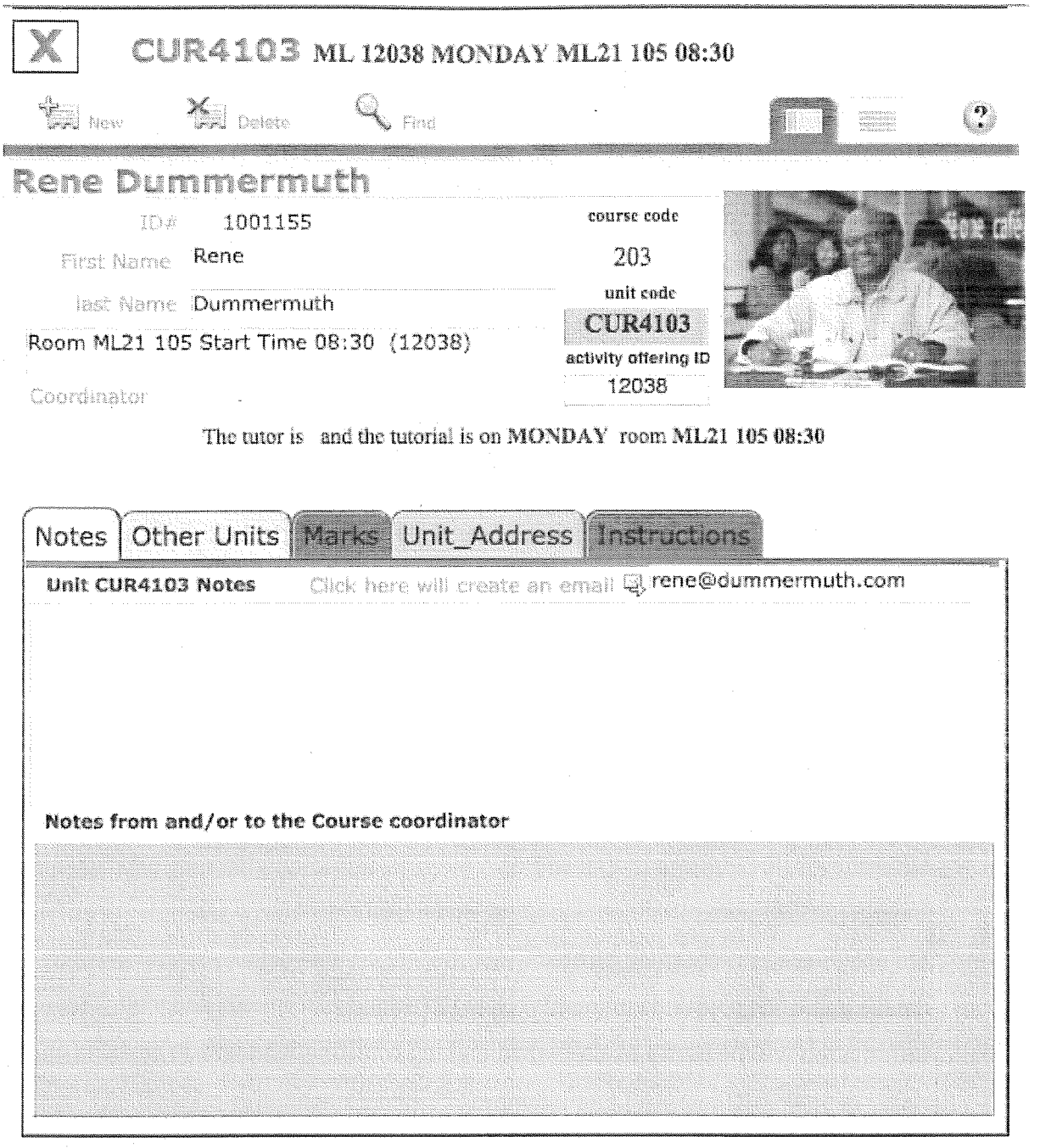

Figure 2: Example of student course details

Collaborative development of the project

The authors, in a cross-discipline collaboration, developed this project. The success of the design is due to the consultation between the ICT expert and the academic co-ordinator resulting in a unique product design, which responds to the teaching and learning needs of the course. There has been ongoing consultation with a number of significant participants in the project. We consulted with the students, tutors and lecturers using the system. We worked with the students and staff to collect the data for

the online survey. We are currently doing ongoing data collection on the effectiveness of this digital filing system and are using this information to refine the system.

Project outcomes

A pilot digital filing system for use by unit and course coordinators has been developed. The system allows student photos, survey data and Callista student details to be imported seamlessly and to be view in many ways, as the following examples demonstrates.

- Tracking of diary entry/notes and the ability to email directly from within the system.
- Course co-ordinators can build a profile of their students developing skills across the course
- Unit and course co-ordinators can have access to current reliable data on the progress of each student with a course.
- Course co-ordinators can compare assessment results across multiple units for consistency.
- Course co-ordinators can monitor the progress of the whole cohort by comparing assessment results between units.
- Course co-ordinators can have authentic evidence in case of student appeals.
- Improved management, communication and tracking of queries at both unit and course level.
- Improved practicum placement based on student survey data.
- On one display the user will be able to see student contact details, school contact details and track note and comments related to school placements and visit. This information will be useful to staff when making confirmation visits to students at risk.
- This information will assist staff to place students in the most appropriate situations for the benefit of both student and school for their practical teaching.

The educational advantage of using this system

The course digital filing system although independent of the EPSS built to support the task assessment process could be linked to enhance both processes. The task assessment EPSS, has proven to be a very effective and has greatly enhanced the assessment process in the program in 2003-6 trials. Currently unit co-ordinators have a range of record keeping systems with the majority of these being paper based. This makes

efficiently keeping and managing of records for large units difficult and unwieldily. A 15 point unit with a cohort of 265 students each doing three assessment points per semester will results in 795 paper based records per semester. The EPSS tool not only includes these assessment records but also attendance records and tutor recommendations could be included and managed. The system allows unit co-ordinators to effectively annotate, manage, store and access records electronically.

The course digital filing system also allows unit coordinators to search records for specific results, assessment items and comments by tutors. This record management system will allow the sharing of information between unit co-ordinators, tutors, course coordinators, and program directors that had previously been impossible or very difficult to accomplish. It facilitates continuity in cases where staff members leave the teaching team. The course digital filing system pages can easily be converted into a PDF format. The PDF can be easily emailed or stored for later access. For example if a program director wanted information regarding a certain students progress, it would take a minute to send them electronically all the assessment records with mark breakdown for that student, all the comments and recommendations made by the tutors to that student and the students attendance records. With a little further development features such as, highest, lowest and average marks for an assessment point could also be included. Using the current paper based system it would take hours for a unit co-ordinator who generally co-ordinates more than one unit to assemble all that data. The benefits for students would be in quality control of teaching, learning and assessment procedures. The easy access of student records if needed in the future is another advantage of the system. This data can be used in the *plan teach review process* to improve course outcomes.

The Unit Co-ordinator, Course Co-ordinator and Program Director can view all unit marks and grades (later version could include assessment points and feedback). Other aspects like attendance and recommendations made by the tutors can be recorded in the system. Whilst the focus of the project will be one specific course, it is expected that the model, processes and artefacts developed will be applicable to any course with multiple tutors and large enrolments.

The Graduate Diploma course attracts students from a wide range of professions all with different skills. The online survey included in this project gathers data about the students' skills, professional background, qualifications, and strengths that helps in optimally placing them in schools for practical teaching, See Figure 3.

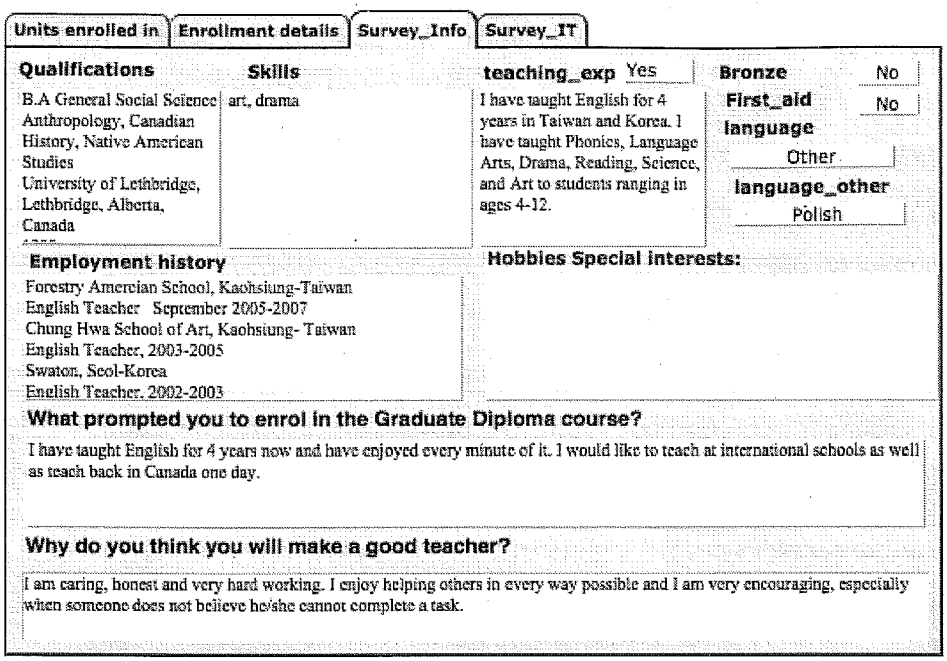

Figure 3: Student survey data

Internal evaluation of the project

Evaluation is an ongoing iterative process and takes place using an action research methodology (plan, act and revise). Consultations are held with the program directors, course co-ordinator, unit co-ordinators and tutors and students throughout the development phases. Expert reaction and feedback from peer unit co-ordinators are occurring in the design and development of the models and resources. Independent academics and technical experts at the Apple University Consortium Conference critiqued the system. This review will be discussed in the following section of the paper.

External evaluation of the project

The models and processes developed are documented and shared within the program and will be implemented more widely following the trials. An academic paper and hands on lab session were presented at Apple University Consortium Create World Conference in November 2007. Participants were provided with a dummy run time version of the system, which they tested on Apple computers. The product received encouraging feedback on its usefulness for academics and university management staff. There were a number of technical recommendations regarding development of a clearer navigation interface and improving the visual appeal of the product. A suggestion from technical developers who attended the presentation was to lock fields to prevent data

being contaminated. These suggestions will be used in the further development of the product. A further pilot study will be conducted in which working models will be produced and given out to interested potential users. This will provide them with a simulation, that they will be able interact with and test. This system is currently being used in the Graduate Diploma Program and reviewed to check its effectiveness. The system will be refined to be shared with other courses and programs.

Significance of this project

This use of interactive online databases can be adapted for any context in which clients have multiple data sources, which need updating and monitoring by a number of individuals. This database can be used in virtual private networks ensuring the integrity and confidentiality of the data. We foresee this application being of use in educational and health care settings where confidential records are needed particularly in rural and remote setting and with migrant populations.

A teaching and learning grant from Edith Cowan University funded this project

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The article above describes how technology has been integrated into the management of a tertiary course to provide better support for the students. It also illustrates how I am using the technology as a tool to support my own preferred learning style which incorporates new technologies to work more efficiently and uses the technology to keep track of all the details while I can focus my energies on developing the bigger picture and engaging in creative ways of engaging the students. The use of technology in this course models to the students how they can use technology in their teaching.

The next paper is one that forms part of a chapter in a book called "Innovative practices in pre-service teacher education: An Asian-Pacific perspective." This book is currently in press. My contribution to the book describes how I have used technology to teaching in flexible modes thus accommodating the learning needs and styles of tertiary learners namely pre-service teachers.

4.16. Teaching the net generation-using digital technologies to accommodate student learning styles in a tertiary setting.

This section describes the innovative use of digital technologies to promote learning and engagement in pre-service teacher education courses. I have selected two case studies for discussion. Case Study one presents the design of coursework incorporating digital technology for first year pre-service teachers. This case study discusses how digital web 2 technologies are integrated into the design of course work to accommodate the preferred learning styles of the students. Case study two concerns post graduate students with different learning needs and styles. In this case study podcasts are designed to match the range of learning needs and skills of the group. An action research model was used in which initial research was undertaken to determine the learning needs and style of the students. An additional survey on ICT competencies also informed the design of the technology used in these units. Finally feedback from students and staff at the completion of the units was carefully considered to refine the work undertaken. This paper will clarify how the technologies can be used to support and empower teaching staff, including those who have minimal experience in this area. Some of the key factors in the design; creation, application and implementation of digital technologies in these units for pre-service teachers are described. Factors constraining the use of these technologies are discussed. Finally some future plans and directions on the design of tertiary units including new technologies are outlined.

This chapter considers the introduction of digital technologies in units for pre-service teacher education. The technology is conceptualised as a teaching tool serving to engage the learners and promote individualised, flexible learning. The technology is applied in different ways to accommodate the learning needs, learning styles and levels of technology skill of the students. There is growing opinion that we need to include more technology in pre-service teacher education courses. Lord Puttnam, the chancellor of the Open University in Britain was recently reported as saying
" Today's` students are digital natives who have never known a world without a computer but are forced to power down when they enter a classroom to cope with their teachers who are digital immigrants suspicious of technology and begrudging its place in schools." (Ferrari, 2007).

In the university context it must be acknowledged that our tertiary students have a wide range of technological skills and experiences yet many of our students could fall into the category of digital natives. All of our students are pre-service teachers who will be the educators of the future and working in a digital environment. The term digital natives was used by Prensky to describe a generation that have grown up surrounded by digital technology as opposed to digital immigrants those who grew up without the technology and are learning to use technology as adults (Prensky, 2001). As a tertiary educator I have noticed that some of our current cohorts of students have different learning styles and expectations to the students I have taught in the past. This realisation has prompted me to explore novel ways to engage students to meet their learning needs. Before beginning to incorporate new technologies in a tertiary unit of study it is advisable to undertake some research to gather data on the learning needs and styles of the students. By gathering data from students before and after they have undertaken tertiary units of study, unit materials can be designed and refined to make them more appropriate to the cohorts needs. A search of the literature on learning theory, instructional design, learning styles and technology provided an informed basis for the development of these digital learning resources.

The initial research undertaken by the writer when developing these materials indicated that one should not assume that students are all digital natives but that students ICT skills are widely spread, from those who have recent tertiary qualifications in technology related disciplines, to those needing support in using very basic applications, like word and spread sheets. Another important element to consider when

including technology in the design of tertiary units of study is the level of skill and expertise of the teaching staff.

Case study 1: The integration of digital video analysis in an online learning portal

This case study presents the integration of digital video analysis in course work of a core unit for cohort first year pre-service teachers. Initially students were invited to participate in a survey to gather data on demographics, their preferred learning styles and learning needs. The questionnaires were completed by 80% of the cohort N 65 students. The data collected indicated that the majority of these first year students fall into a group loosely identified by sociologists as Generation Y. Sheahan categorised Generation Y those born between 1981–1995 (Sheahan, 2005b). There are a number of other descriptors for this group in the literature, those born between 1977-1997 are also referred to as the Net Generation and the I Generation (Pink, 2005; Prensky, 2001). Pink (2005) felt that this group have been shaped by growing up in a digital world which will influence their preferred learning needs and styles. A distinguishing feature of this group is that they want authentic compelling programs. The demographics of this group were skewed being approximately 85% female. This is fairly representative of the population of early childhood and primary pre-service teachers involved in this part of the case study. There is evidence that female students may lack confidence in using technology and prefer to use technology for specific structured tasks (Lane, 2005b). This factor was considered in the design of the tasks and the inclusion of a range of support materials in the form of podcasts and QuickTime movies with audio and visual instruction sheets.

The research work of Howard Gardiner at Harvard University in Project Zero describes specific ways of learning and processing information linked to the neurological processing styles (Gardner, 1999, 2004). This work on learning styles was used in a voluntary survey completed by most of the cohort. The data obtained from the surveys completed by this cohort of students revealed that a large percentage of the respondents preferred to learn using a kinaesthetic learning style, which means that they like to learn by physically engaging in a task. A large number of respondents indicated that they liked to learn through being visually exposed to material. According to this data the students indicated that their least preferred learning style was auditory indicating that they did not rate listening to lectures as their most effective way of learning. Yet when we look at our modes of delivery in tertiary education a large

proportion of our teaching is delivered in this passive auditory mode. A significant proportion indicated that they were both visual and kinaesthetic learners, implying that they liked to learn through visual pathways and by being actively involved in the learning event. Large numbers indicated that they liked to use technology for learning.

The results of this research motivated me to redesign a core unit in educational psychology to incorporate more technology, more visual elements and more engaging tasks. A supporting factor for the integration of more technology in these tertiary units is that the pre-service teachers we are training will be moving into classrooms in the future, where they will be expected to include technology in many spheres of their teaching. Thus, we need to ensure that they are confident users of many different modes and applications of technology. An effective way of transferring this learning in an adult context is by modelling the effective use of technology in tertiary education courses. This supported our decision to transform the unit materials from largely paper based to a wider range of multi-modal resources presented in an online setting. There are many restraining factors, which include the age of tertiary educators as well as the lack of experience and confidence in using technology of many tertiary educators. There can also be a lack of support in the form of time, resources and training in many tertiary institutions.

The unit of work selected for redesign is a core unit in educational psychology and contains a large amount of theory. Historically students have found it difficult to relate the theory to real life classroom practices. This gap has been particularly relevant to the courses in curriculum studies and educational theory. The rationale behind using digital video case studies in these courses for teacher educators is to juxtapose theory and reality by combining the visual image of a real teacher in a classroom and the theoretical constructs under pinning teaching practice (Olivero, John, & Sutherland, 2004). Video has a long history of being incorporated into teacher education programmes with varying degrees of success (Perry & Talley, 2001). The use of video as purely a visual representation has certain limitations from an educational perspective. When the participant is required to passively view a selection of video there is a limit placed on their active involvement as a learner. The advances in technology and the development of digital video particularly the introduction of QuickTime, Apple Computer's format for time-based and streaming data formats, which appeared in beta form around 1990 makes it easier to include streaming video footage in online settings.

This use of streamed digital video allows the manipulation of video footage in an online digital format. The advances in technology that allow this digital video

footage to be housed on a web-based portal and streamed on command to the viewer allow for more active involvement of the learner (Steigler & Hiebert, 1999). An online learning management portal called Lessonlab was selected for this unit because it includes a range of features, which allows the active participation, and engagement of the students in the learning activities. In the Lessonlab platform the viewer has a great deal of control over his or her own learning.

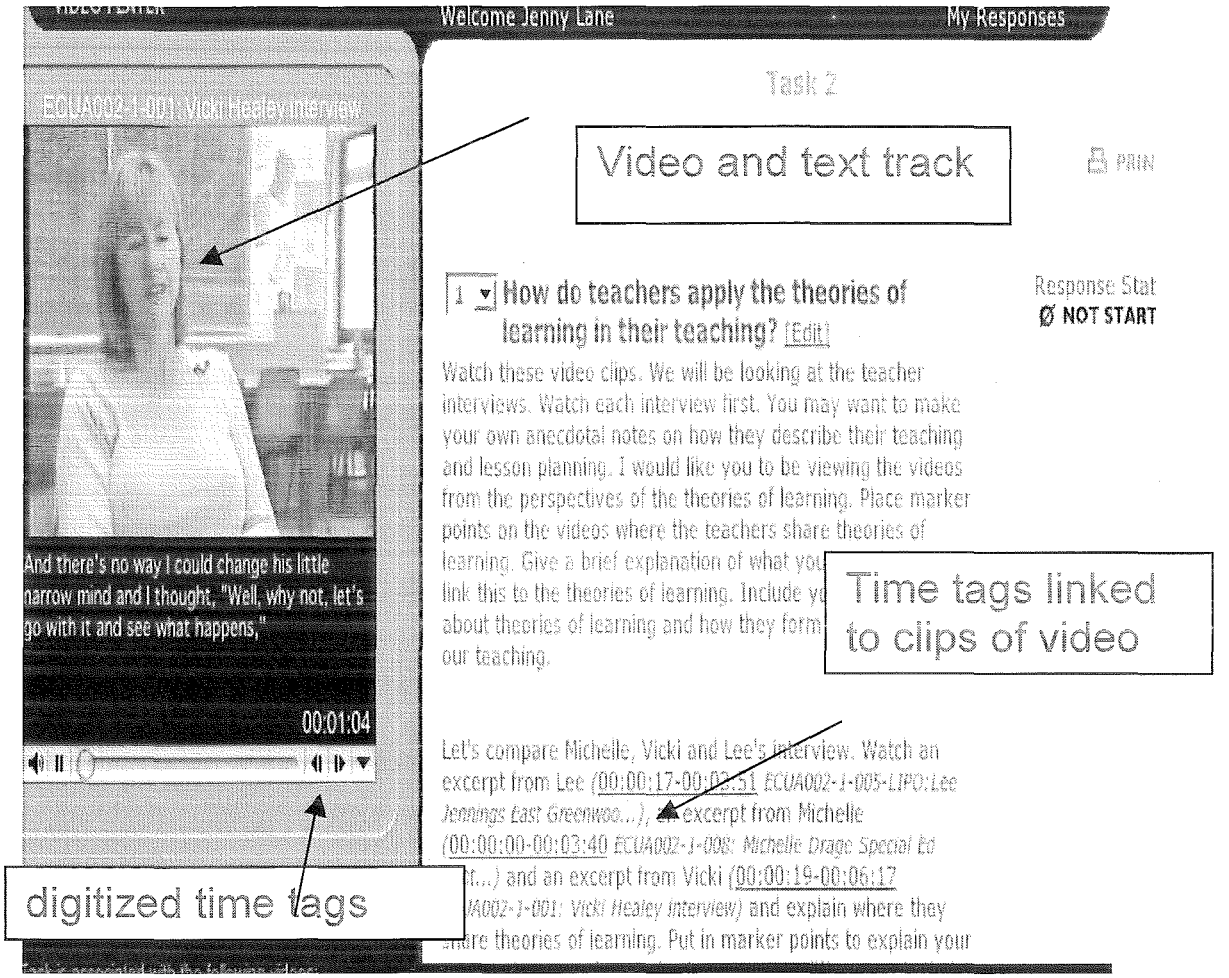

Figure 1: The web-page including video tasks

The viewer can decided when they want to view the video, which section of video they want to view, how often they need to view the video to suit their own learning style. The viewer can also decide if they need to see the text track together with the visual image and the sound track or if they prefer to just sight the text track. Thus, in this format the learner can customise the learning experience to suit his or her own specific learning needs and preferences. This is where the advances in technology that facilitate the streaming of digital video have provided great advantages to the educator and to the learn providing a flexible learning environment to accommodate differences in learning

style, tempo and modality. This platform has taken the control of the learning experience from the educator and placed it in the hands of learner who can customise his or her learning experience to meet their own pedagogical needs. This transforms the learning journey from one that is teacher controlled to one that is controlled by the individual learner.

Another feature of this platform is that in traditional use of video, the instructor decides which section of video best illustrates a particularly theoretical stance. An advantage of this use of digital video analysis in the Lessonlab platform is that the learner inserts marker points in the video and can link those markers to an analysis that they have constructed. This gives the learner ultimate control and allows them to demonstrate that they have reached a point of knowledge transfer or bridging by linking the theory to real life practise.

Discussion of the qualitative findings of this case study

A focus group was held with a group of six student volunteers from the first year pre-service teacher cohort who participated in the course in the first year of implementation. This data was used to refine the unit materials and support for future cohorts. The general consensus from the students was that they enjoyed using the interface (Newhouse, Lane, & Brown, 2007). The main difficulties were concerned with access to technology. The students suggested that more training in navigating the web-based platform could be given at the beginning of the course. The students felt they needed more support by teaching staff during tutorial sessions and access to computers during their tutorial sessions. This would reduce the high cognitive load some students experienced when working in a web-based format for the first time. The students also suggested that a handbook be produced to guide them through the technical aspects of the site. One student commented that it was the most difficult and challenging of the first year units that she had done but that she enjoyed it as it was stimulating and challenging. The students were supportive of the fact that the online environment was being implemented in this course for the first time.

Most of the participants in the course completed a questionnaire. In these students commented on how they liked the flexibility of the course, in that they could complete the online components in their own time. The students enjoyed the range of contents of the course and range and variety of the online activities. They felt it made them think and take responsibility for their own learning. They found the video clips

interesting and relevant. Some students commented that doing the online tasks took too much time in relation to the percentage of marks allocated to the task. A general trend was that the more mature aged students found the use of the online environment more stressful. Generally these students made use of the additional support workshops offered and progressed well in the course. There were a few students who dropped out of the course in the final weeks. Unfortunately they did not contact the teaching team so it is difficult to determine the reasons for their withdrawal from the unit. This information has been used in further course developments, some of which will be discussed in case study two. This includes how technology in the form of instructional podcasts supports students through the aspects of the course.

Case study two: The use of podcasts in pre-service teacher education

A podcast is a digital media file, which is distributed over the internet. These files can be in different formats, which allow them to be downloaded on to personal media players, for example Ipods, or played on computers. Initially these files were audio or radio files but more recently technology has advanced so that enhanced podcasts can include images, documents and videos. The podcasts can be distributed in different ways. The use of RSS feeds or push technology allows users to subscribe to a series of podcasts whereby new episodes will be automatically "pushed" or downloaded on to their selected devices when they log on to I-tunes. Podcasts can also be saved in smaller file formats allowing them to be sent via email to all course participants. This was the method I selected for this project.

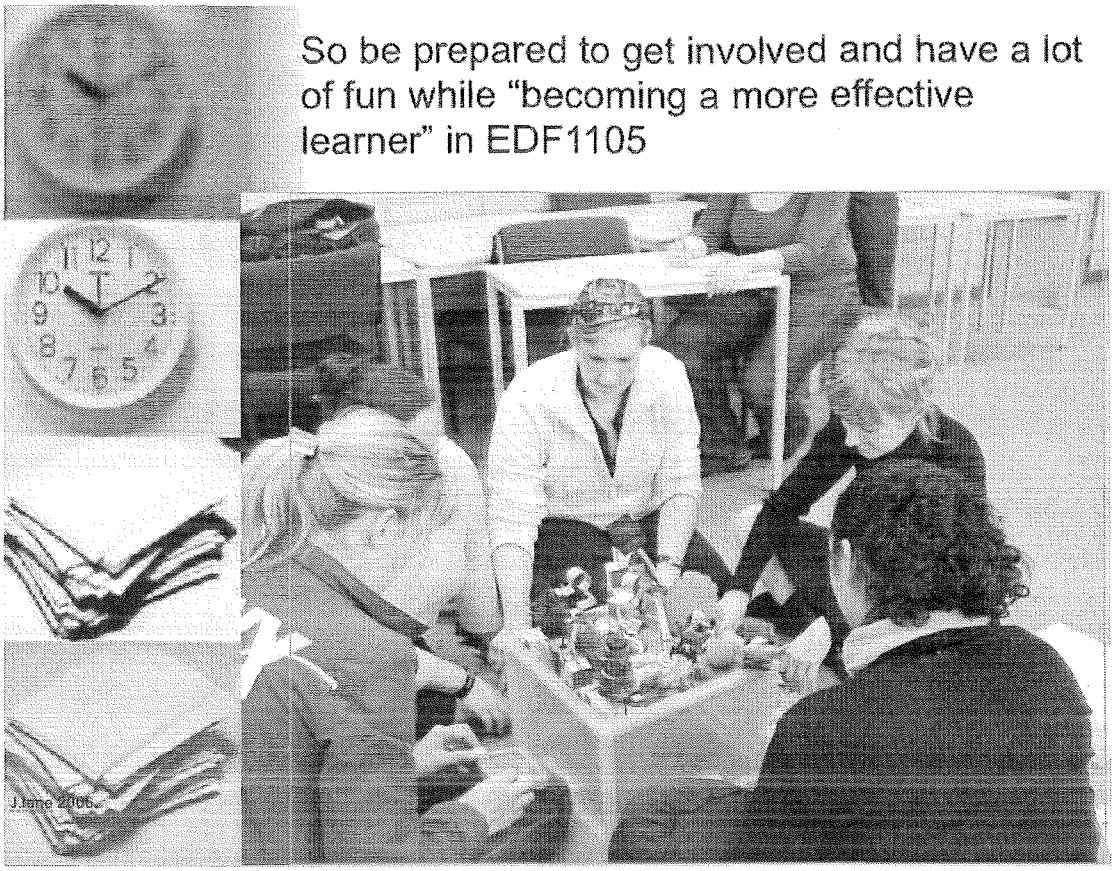

Figure 2: An example of one of the screens of an enhanced video podcast

In this case study podcasting was used as a way of providing a more challenging and engaging learning experience in a range of units. The podcasting project has been designed in response to feedback from students that they want learning materials to be available in a range of formats so they customise their learning to suit their own learning needs and styles.

I have used podcasting in the Graduate Diploma of Primary Education Course N.162 students across two campuses in the metro area. The Graduate Diploma course is a challenging context in which to teach. The students are working at a post graduate level completing their education studies in one year as opposed to the four years of study undertaken in the under graduate programme. There are numerous teaching and learning challenges to be considered when designing units of course work for this cohort of students. The current financial situation of many students requires them to engage in many hours of paid work while completing their courses. Students` time has become a very valued commodity. Academic staff need to design materials that provide focussed learning opportunities maximising on pockets of time available to students. This prompted me to use podcasts and provide materials in a flexible manner. Students

can now access course materials while travelling to university or work using portable devices or download them on to any computer.

Another challenge is that students are indicating that they do not have the time or inclination to engage with large quantities of reading materials. As an educator my aim is to get students to engage with the material. This prompted me to look for new ways to present material which may be more suited to the learning styles and needs of the current group of learners. When surveying the cohort, large numbers indicated that they have access to MP3 players, which supported the use of this technology as a medium to deliver course materials. All students in the group indicated that they had access to computers at home. A significant number had broadband access while some had dial up modems. This prompted the decision to deliver selected material via podcasts. The podcasts were designed in a format so that they could be downloaded and viewed on a computer or an mp3 player. Technical challenges were to keep the file size small enough for those students who only had dial up computer access while still offering clear high quality material.

The educational backgrounds of students in this course vary. This provides a great challenge to the teaching team to deliver content at the correct level of challenge for the students. In this unit on educational psychology as there are a number of students who have masters degrees in psychology, some doctoral degrees in this area but there are many others who come from different fields so have very little background knowledge on topics dealt with in this unit. The technology is used to deliver unit content so that students can customise their learning experience by selecting the podcasts and digital resources that they need to suit their learning needs and style.

Podcasts are used to deliver background information to students prior to the lecture and workshops. In this way students can select which areas of background knowledge they needed to cover before the lecture. Those with advanced understandings of the topic can choose to move quickly through the material using their time more effectively for readings and research at an advanced level. Those students with less background in this area could work at their own pace reviewing the podcasts, pausing the presentation and replaying sections when needed. In this way the students were encouraged to engage and control their own learning.

This use of technology also caters for diversity as the podcasts provide both visual and auditory input and give the student control over the rate of delivery, the length of time they need to engage with the material and the number of times they need to hear or view material in order to learn effectively. This makes this use of technology

suitable for students with barriers to learning, visual or auditory processing difficulties, language difficulties as well as those with work or family commitments giving them full control over their learning with these resources available This use of podcasts to transmit essential content prior to the lecture allows the lecturer to use contact time with the students in a more meaningful way, to further engage them in their learning by getting them to engage in advance seminars in which they apply the content to a range of educational settings using dilemmas, case studies and video scenarios of classroom teaching. This again challenged students understanding and they were able to participate at their own level, with the students who had more experience in the area raising the level of the debate and questioning. I also used podcasts after the lecture to deliver further information in response to the questions raised by the students in the lecture.

The second way podcasts were used for post graduate students and undergraduate students was to deliver " just in time learning" in order to support students engaging in an online exercise in which they needed to register and log on to a password protected website and configure their computers to do a specific task. Traditionally this has been a challenging task as the students have varying degrees of technological competencies ranging from mature aged students who do not know how to switch on a computer to recently graduated students with degrees in technology related subjects. The podcasts are used to talk student through the technological process of engaging with the technology.

This proved to be very successful. In previous years the academic staff had to spend a lot of valuable teaching time guiding students through the technical challenges of accessing an online learning portal and engaging in analysis of digital video case studies of classroom teaching. This year when using the podcasts all of the students managed to engage and successfully complete their tasks without needing additional assistance from staff. This reduced the workload for staff and the frustration for students because they had the help from the podcasts where ever and whenever they needed it. This also removed the technological challenge from the task, allowing students to engage in the academic challenge and use their time effectively. The teaching staff noticed a vast improvement over previous years with most students successfully managing to negotiate the technical challenges. One of the academic staff in this unit commented that the clarity of the podcasts were most useful in assisting the thought this process.

In this unit the podcasts were also used to give addition support in completing an assignment. Examples of previous years assignments were included with additional

hints and tips on how to meet the assignment criteria. This was most useful in that students could view this at their time of need and ensured that all students received the same level of support across multiple tutorial groups. I have found the use of podcasting most successful and would like to experiment further with this technology next semester. My plan is to get the students engage in creating their own podcasts as part of their learning experience.

Conclusion

The reality is that outside tertiary institutions there is a rapid increase in the use of new technologies. The majority of our students are using digital technologies on a daily basis for many of their communication and entertainment needs. It is a logical step to harness these technologies to engage our students and provide a richer, deeper learning experience. In this era of rapid technological innovation, the use of digital video and podcasts can become very effective teaching tools if we harness the technology and use it in an educationally sound way to promote learning. The newest MP3 players have the facility to store and play video footage and the new generation of mobile phone and wireless devices can stream video so as educators there is a wealth of instructional opportunity for us our challenge is are we going to exploit these advances to our advantage and the benefit of our learners or are we going to miss this chance to adapt our teaching to meet the needs and challenges of learning and thinking in a digital age?

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CHAPTER 5

Future directions in pre-service teacher education in WA

Ch 1 Introduction	Ch 2 Lit review	Ch 3 Research Phase1 Teachers	Ch 4 Research Phase 2 Preservice Teachers	Ch 4 Research Phase 3 Post Grad Students	Ch 4 Research Phase 4 Technology in teaching	Ch 5 Future of Teacher Education	Ch 6 Conclusion

Figure 27: Portfolio progress chart chapter 5

The work completed in this portfolio so far has made me reflect on the shape and nature of the work I do at a tertiary institution to prepare tomorrows` teachers. I have used the lens of learning style theory to frame my reflections and investigations. I have presented work on a micro level considering individual and course level interventions for pre-service teacher preparation. In the following sections I expand my thinking to broader concerns looking at the macro-context, engaging in overarching future planning for the training of teachers in Western Australia. I have included two papers, which document my thinking on the current situation in Western Australia regarding the pre-service teacher education. The first paper has been published in The Australian Journal of Teacher Education, January 2008. It begins by describing the current crisis in teacher eduction and concludes by offering scenarios that offer a vision for the educational provision in this sector.

5.1 The Resources Boom: Cash Cow or Crisis for Pre-service Teacher Education in Western Australia?

Abstract

This is a research paper describing the impact of globalisation on the provision of pre-service teacher education in Western Australia. The author utilises a range of research methodologies to gather and analyse current data, finally a range of possible futuristic scenarios are presented. The paper has significance for those concerned with future policy and planning in the area of pre-service teacher education yet has a broader impact for all educational planners. It is written from the perspective of a concerned tertiary educator with over twenty-five years experience in education. The author currently co-ordinates a

post-graduate course in pre-service teacher education at a university in Western Australia.

> We need to understand the nature of growth processes and how to catalyse them. But we also need to understand the forces and challenges that impede progress, and to develop workable strategies for dealing with these challenges. We need to understand the dance of change, the inevitable interplay between growth processes and limiting processes (Senge, 2001).

In this paper I make connections between the current resources boom in Western Australia and pre-service teacher education. I begin by portraying the Resources boom as a direct consequence of globalisation, and then proceed to notice how this economic boom is impacting on pre-service teacher education. Following this, problems and dilemmas in pre-service teacher education will be presented and the roles played by state and federal government in encouraging enrolments and providing resources for teacher education courses will be critiqued. Finally, forecasting models will be used to create a range of scenarios for the future provision of pre-service teacher education in WA.

GLOBALISATION

Globalisation has been described as " *an unavoidable train that is rolling towards us*" (Mc Shane & Travaglione, 2005. pp.8). International competitiveness has emerged as a driving factor of world economies. The competition has shifted from being based on geography to a worldwide perspective. Regardless of whether we agree or disagree with the underlying principles of globalisation, it seems inevitable that we will be touched by its influences. Although we are very geographically isolated in Western Australia, we are subject to the influence of globalisation. However, there are areas where governments do have a measure of control over those influences. In this paper two questions will be put to readers. Firstly, are the state and federal governments thinking "smartly' about pre-service teacher education, given the windfall from the Resources

boom? Secondly, can both state and federal governments use the state of disequilibrium or crisis caused by the forces of globalisation to drive meaningful change in pre-service teacher education? The way in which both state and federal government respond to the emerging situation of a potential teacher shortage in WA is critical.

In this paper globalisation will be considered from the perspective of systems theory (Bronfenbrenner, 1990), which has emerged from the literature on organisational management. Bronfenbrenner (1990) describes ecological systems theory as a concept of interrelated systems in which all layers of the system are connected, rather like how when you drop a pebble into a pond the ripples will radiate from the point of entry to the edges.

The global system has become increasingly interconnected due to advances in technology and to international policies and trade agreements (Bronfenbrenner, 1990). When we consider our society from a systems perspective, it becomes apparent that there are no longer clear divisions between economic, educational and social policies and all are likely to impact on any decision making process (Hveem & Nordhaug, 2002). A characteristic of globalisation is that systems have become more open to outside forces. As an open system, organizations need to be aware of any changes in the environment and change their behaviour to fit the new conditions

Globalisation impacts on the issue of pre-service teacher education when the economic activities of one state are extended to other parts of the world (Mc Shane & Travaglione, 2005b). In a globalised society local markets are open to economic forces and pressures from beyond its state or national borders and have to survive the economic, ethical and cultural pressure of the wider marketplace. There are currently large demands for resources by, in particular China and India. The effect of this demand has impacted on the social and economic conditions in Western Australia. This can be seen in the rapid population growth caused by internal and external immigration, labour shortages, increased personal wealth and windfall growth in royalties to government. There has also been a loss of market share from the public education sector. The teaching sector has failed to compete with other professions to attract and keep staff due to uncompetitive wages and general career prospects. There has also been a decline in the funding base for universities. These are some of the forces of globalisation, which are currently having a direct effect on the number of students enrolling in pre-service

teacher education courses in Western Australia. These points will be discussed further in this paper.

EDUCATION IN AUSTRALIA

At present (2007) there is much discussion concerning educational provision and policy in Australia. In Australia, educational provision is the mandate of both the state and federal Governments (Education-International, 2006; Joseph, 2006; Minzberg, 1996). The federal government has control over the funding of tertiary education, while primary and secondary education are predominantly state funded, with some specially targeted funding coming from federal sources. With layers of power and control divided between state and federal governments, which may have opposing party political affiliations, there is cause for much conflict and political tension. In this paper the focus will be on both state and federal government responses to global pressures on pre-service teacher education in the Western Australian context.

When considering education and globalisation in Australia one needs to look beyond the surface rhetoric to determine what is causing the shortage of pre-service teachers. I now discuss some of the factors contributing to this shortage.

THE DEVELOPING EDUCATIONAL CRISIS

Currently the educational system in Western Australia is headed into crisis. Many teachers are leaving the profession because there is rapid change in the curriculum, the teaching workforce is ageing dramatically (Reid, 1999). In July 2006 the Minister of Education in Western Australia established a working party to investigate issues of teacher supply and demand under the leadership of Professor Lance Twomey. In an interim report released by the Twomey Task force it is acknowledged that accurate data on the teaching supply and demand situation in Western Australia is difficult to obtain because of the nature of data held by the Department of Education and Training and the independent education sectors. The report states although data is incomplete it does indicate a "very tight labour market" with "potential problems facing the state in meeting the demand for teachers in the short and medium term."(Department of Education and Training, 2006). The Twomey task force recognise the significance of the drop in the number of students enrolling in teacher education courses (Department

of Education and Training, 2006). When analysing the data provided by the Tertiary Institutions Service Centre (TISC) for education courses, over the past five years the TISC first preference figures have dropped by over 20% when averaged across education courses of study in Western Australia. The 2007 TISC first preference figures for education courses at all universities in Western Australia show an increase of 6.2% over the 2006 figures (ECU, 2007). This small increase is in the area of primary education while there has been a decrease in the TISC figures for secondary education courses of study at the three largest Universities in WA. This small increase in first preferences in primary education is not enough to compensate for the much larger decreases in this area over the past five years. There is a long term trend of reduced enrolments in secondary teacher education courses, particularly in specialist areas such as LOTE, languages other than English, mathematics and sciences(Department of Education and Training, 2006). These areas have been indicated as areas with serious shortages of trained teachers as indicated in the Twomey Task Forces` interim report(Department of Education and Training, 2006). When these figures are viewed against the growth in population in WA, it is evident that these factors combined will almost certainly result in a serious undersupply of teachers in the near future (House of Representatives, 2007; Ministerial Council on Education, 2004).

In fact there is already an undersupply: in January 2007 and again in August 2007 there were not enough teachers to fill all positions at the start of the new school terms. Throughout the year school have struggled to find relief teachers and a number of teaching positions were not filled. There have been teacher shortages at crucial times in the past but this situation appears to be longer term. This undersupply is being compounded by the ongoing growth in population as a result of people migrating to the state attracted by the current economic boom, and of natural growth stimulated by the "baby bonus" cash paid to parents on the birth of a child. These bumps in the birth rate will reflect in school enrolments in five years time approximately the same time when the decreased cohorts of pre-service teachers are due to enter the workforce.

Professor Greg Robson, a member of the Twomey task force investigating the teacher shortage in WA stated the current economic boom in WA is significantly different to past cycles of boom and bust economics as seen in WA the past. This growth pattern is part of a long term cycle of fiscal growth under pinned by huge demand for Resources in China and can be expected to continue on this projectory for many years in the

future. Professor Robson stated that we currently have a critical problem in providing trained teachers for all classrooms in WA and the situation needs urgent attention "we need a radical re-think about the career structure of teaching, the way we recruit and the need for a major re-alignment for the status of the profession. As for teacher education we do need to keep pushing forward on improvements and in how we perform our role - but a radical re-think could mean lots of things. I would prefer to use terms like improving flexibility, forging stronger links between theory and practice, and with our school partners. As well there is a need to lift the investment in teacher education." (Robson, 2007).

Furthermore, there are frequent statements in Western Australia's daily newspaper criticising teaching and the outcomes-based curriculum in Western Australia. Needless to say, this criticism demoralises the current workforce and does not help in attracting students to the profession. There is little evidence that the Federal and State Governments are working together for the future of this sector to avert the shortage of teachers. In the following section global factors influencing the economy of Western Australia will be examined.

THE RESOURCES BOOM AND THE ECONOMY

Western Australia is the largest of the seven states in Australia. The geographical location of its capital city Perth makes it one of the most isolated cities in the world. It has a population of only two million. However, Western Australia has been recently described as the powerhouse in the Australian economy largely as a result of exports of raw materials. Western Australia has large deposits of iron ore, uranium, magnesium, natural gas and coal, and is currently experiencing a period of economic growth because of the demand for these raw materials especially by China and India (Australian Bureau of Statistics, 2007). China is currently in an expansionist period, in keeping with its adoption of global free market principles. The demand for these raw materials has resulted in an increase in the cost price per unit of these Resources, which has facilitated the opening of new mines and the production of older mines that previously were not economically viable. These favourable market conditions have resulted in an economic boom, with increased individual wealth, stimulating the local economy and leading to housing and labour shortage.

The taxes on the Resources have boosted the coffers of both the federal government and the state government. But there is conflict between the State and Federal Government about the equitable distribution of this wealth. A contributing factor to this conflict is the opposing political ideologies of the Liberal Party currently in federal government and the Labour Party in state government. No doubt other federal- state issues, such as industrial relations, exacerbate this conflict.

The figures from the Federal Treasury listed by the Australian Bureau of Statistics (Australian Bureau of Statistics) indicate that private sector wealth in Australia exceeded $7 trillion at the end of June 2006. A comparison of the 2005 and the 2006 statistics show that in one year the average Australian became $11 000 richer, with per capita assets of $348 000. Since 2001, private sector wealth has increased by 91.2 %, the biggest five-year gain in the past 46 years (Australian Bureau of Statistics, 2007). The standard of living in Australia based on the 2005 domestic income per capita lists Western Australia as having the highest % growth per annum (PA) for the last 15 years. This % growth PA of 2.6% in WA is 25% higher than the national growth rate PA of 2.0%, with NSW second highest, having a 1.8% growth PA (ABS, 2006). These figures indicate the extent of the influence of the resources boom on the economic situation in Australia and, specifically, in Western Australia. This higher annual growth rate in Western Australia can be linked to the resources boom and seen as a result of globalisation. But this begs the questions: What are the governments doing with this wealth? Is it being reinvested in areas that will benefit our society in the future?

As one might expect, the resources boom has created many jobs but this has not benefited all wage earners in the state. The unemployment rate in WA is continuing to decrease from 4.8% in 2006 to the current figure of 3.2% in October 2007 (Department of Treasury and Finance, 2007). There are now labour shortages in many areas. In order to attract labour to the mines, very attractive salary packages are being offered, which means that some school leavers and those in lower income jobs can earn large salaries for unskilled or semi-skilled work. According to figures released by the Federal Department of Employment and Workplace Relations` the skilled workplace vacancies index rose 1.2% in October 2006; and there are indications that labour shortages may not have reached their peak (Australian Bureau of Statistics, 2007)However, the demand for skilled and semi-skilled workers has contributed to the crisis for pre-service

teacher education in WA. In the next section I will describe the current downfall in enrolments in pre-service teacher education in WA.

ENROLMENTS IN TERTIARY EDUCATION

The 2007 figures for first preferences for commencing students in all higher education courses WA indicates a slight increase but many areas still experienced a decrease in numbers in TISC first preferences. In November 2007 TISC figures for teacher education courses in all universities in WA are currently down 0.4% and other service professions like nursing are currently down 7.4% over 2006 first preference data. The humanities sector is down 33% over 2006 figures (ECU, 2007). Many of the WA students enter professions linked to the resources sector, as the high salaries offered by this sector have become very attractive. The official figures for 2007 new enrolments are not yet available on ABS, but the unofficial figures are indicating a slight improvement over the 2006 figures. In 2006 there significant drop in demand for University places in Western Australia of between 8%-11% when compared to the 2005 data(ECU, 2007).

The Australian federal government gives universities a set amount of funding for each subsidised student enrolled. In 2006 legislation was introduced requiring Universities have to return funding if enrolments did not meet the targets. The university were I work could have to pay back up to $14.5 million because its student enrolment in 2006 was 11% short of the targets (Hiatt, 2006). In the follow section the implications of the reduced enrolments will be considered.

IMPLICATIONS OF REDUCED ENROLMENTS FOR PRE-SERVICE TEACHER EDUCATION

This loss in student numbers in pre-service teacher education courses has led to a significant budget shortfall in the university resulting in cutbacks and large-scale retrenchments of staff in order to cut costs (Angus, 2006). Budgets have been cut significantly in all education courses, limiting innovative teaching strategies and forcing course redesign to reduce contact hours and thereby cut costs. There has also been an increase in the number of sessional staff used with resulting increases in the workloads

of tenured staff who co-ordinate these units. Furthermore, minimum course entry levels have been lowered in order to attract more students. Students are now admitted to teacher education courses via portfolio pathways. These students do not have to provide a TER score but have an interview and provide a portfolio. They do need to have passed English and obtain set scores on school assessed subjects.

The reduced intakes of students will translate into significantly reduced numbers of qualified teachers graduating in the future. Currently national data forecasts a teacher shortage from 2007 until 2009 (Lock, 2006), with demand to increase by 11% in Australia. The Ministerial Council on Education, Employment, Training and Youth Affairs (Ministerial Council on Education) report (2004) states that there is the potential for significant teacher shortages through to 2014 (Ministerial Council on Education, 2004). Furthermore, at the international level, there is a high demand for primary school teachers in the USA, the UK, the Middle East and developing countries in Asia- all placing further demands on the available stock of teachers.

There is some disagreement about the factors contributing to the lower enrolment figures. But it is accepted that Western Australia's booming economy has induced many school leavers to take up employment instead of further study. The University where I work has traditionally relied on a large percentage of mature-aged learners, but this cohort has significantly diminished in number due to the large number of jobs available in the current booming economy in WA.

Because pre-service teacher education courses in WA are currently enrolling smaller cohorts, there will be fewer graduates entering the teaching profession in the future. Once these students graduate they will have many employment opportunities, with both local and international school systems offering attractive prospects, so there is no guarantee that graduates will pursue a teaching career in WA (Commonwealth-Australia, 2007). In fact the figures are indicating that a large number of new graduates who enter the teaching profession leave within the first five years (Department of Education and Training, 2006). Industries experiencing labour shortages offer high commencing salaries to attract staff, particularly those who are graduates.

The reality is that government-dominated service industries, like teaching, are not competitive in offering market comparable salaries. In line with the free market

economy, private education providers are offering higher salaries than the government sector to attract good teachers. This combined with the school-based recruitment policy, where principals recruit and select the staff needed for the school followed by private schools allows them to attract the best graduates. While school-based selection is used in some instances in the public sector, public school principals cannot offer higher pay to attract quality staff, and DET continues to impose rigorous constraints on the employment of new graduates particularly in relation to permanent employment. The public sector has made small changes to recruitment by starting to select staff earlier in the year but still relies on a central recruitment pool, which allocates staff to schools. This slow process does not use the leadership skills of principals to interview and select the right applicant for the job it relies mainly on a computer to match applicants to jobs. The government sector has not yet adjusted teacher's salaries to compete on the open market and this makes the sector even more unappealing to potential teachers in the current market conditions.

A significant proportion of DET`s approximately 770 schools are located in remote and often personally challenging areas and many public schools are classified as being "difficult to staff" because of their location, community context or student profile. In the following section a training models from business and industry are examined to see if they could offer alternatives to the present forms of pre-service teacher education.

EXAMPES OF TRAINING MODELS FROM OTHER INDUSTRIES

In areas of strategic demand, apprenticeship or workplace learning models can be utilised. In these models trainees do a combination of practical and academic study. The academic component, is provided by the Government free of charge or at low cost and they are paid by the government during the training. This ensures that certain professions have a supply of well-trained workers. This funding model would be one way of investing the economic benefits of the resources boom to attract students to the teaching profession. At present pre-service teachers do not earn any income during their training and are required to pay high university course fees.

All pre-service teacher courses all include practical teaching components known as workplace learning (WPL) units, in which the pre-service teachers work full time in

schools assisting teachers while practising their skills. In their final year of study, the pre-service teachers have a ten-week WPL in which they teach 100% of the mentor teachers` load and are referred to as assistant teachers. In the current model they are given no remuneration for this period of internship. In the next section I explore challenges to government in relation to pre-service teacher education in the context of the knowledge economy.

THE KNOWLEDGE ECONOMY: A CHALLENGE TO GOVERNMENT

A challenge to the Australian Government is that the forces of globalisation that are pushing the resources boom and creating the labour imbalance are also the drivers of the knowledge economy. Spring (1998, p.105) has linked education to economic growth

> Economic growth is the goal of the learning society organised around learning relationships. In this context education becomes instrumental to gaining a competitive edge in a global economy.

This view implies that education provision is central in a globally competitive environment(Spring, 1998). Currently there are those hardliners who see economic growth, rather than the development of the well-rounded citizen, as the goal of the learning society, they have been in the ascendant in government policy making at the national level. In this context, education is seen as being instrumental to gaining a competitive edge in the global economy. The global world economy has led to increased economic competition (Neef, 1998), forcing nations to improve their technology skills and make new demands on workers. It is likely that the workers of the future will have to have quite high- order thinking skills. The growth of knowledge-based industries and the outsourcing of production to less-developed economies, where unit labour costs are lower, have shifted the criteria for employability in developed countries like Australia from "*brawn to brains*" (Neef, 1998,P.1). A growing percentage of the gross national product (GNP) of developed countries is now coming from high-skilled services (Hargreaves, 2003).

Higher -order thinking skills, problem solving and creativity are essential skills for success in this knowledge-based economy (Pink, 2005). This means that a good quality

education will be essential if our workers are to survive in the competitive workplaces of the future. Future teachers need to be able to deliver that kind of education. Thus, high quality training for future teachers is essential. We also need to be attracting the brightest and the best students to provide the type of high quality, technology-rich education, which will be needed to equip future citizens. In the following section the funding of pre-service teacher education courses are discussed.

THE CURRENT BUDGET CRISIS IN PRE-SERVICE TEACHER EDUCATION IN WA.

Currently, academics in pre-service teacher education courses in WA are constantly being told to cut costs. As a result future of cutting-edge technology used in some pre-service teacher education courses is currently in the balance. Yet research is indicating that academics and students see the teaching technology as being of considerable academic value (Donneson, 2007; C. P. Newhouse, Lane, & Brown, 2007). The use of more technology in teacher education courses is recommend by the Top of the Class Report into teacher education yet we are having to reduce the use of technology in our courses(House of Representatives, 2007). Governments should be using the windfall of the resources boom to support this kind of innovation and high quality training for pre-service teachers.

By boosting funding for pre-service teacher education, the two levels of government would be investing in the country's future. If one considers global economic trends in times of economic surplus, additional funds could be used to build up infrastructure and to train workers of the future (Education-International, 2006). It is paradoxical that in WA we are experiencing an economic boom, yet the Australian government is implementing harsh fiscal cutbacks to services that are essential to the nation's long-term prosperity. By boosting funding for pre-service teacher eduction, it would be investing in the country's future. I now present some future scenarios showcasing how government might respond to the situation that has arisen in pre-service teacher education in Western Australia.

FUTURE SCENARIOS

In many areas of business, experts in the field use the available past and current data to consider international and global developments and make reasonable predictions of the state of the market in the future (Mc Shane & Travaglione, 2005b). In writing this paper a similar approach has been followed. A number of forecasting techniques have been used for example causal layered analysis (Inayatullah, 2006), comparative studies, and environmental scanning have been used to structure the data.

SCENARIO 1: THE LOW ROAD OR THE CRISIS MODEL

The federal government continues to reduce government spending on services. This may entail making pre-service teacher education self-funding by allowing universities to set their own charges for courses. But the increased costs would result in an even lower demand for those courses. The net result would be that fewer teachers would be trained exacerbating the future teacher shortage. A number of possible outcomes can be suggested:

Outcome 1: Class sizes in public schools are increased. This increases the efficiency (cost per student) but reduces the effectiveness (achievement of educational objectives) of schooling and causes more parents to move their children to private schools. This would affects the social structure of Australian society with good-quality education a monopoly of the wealthy and allowing the development of a social underclass that would be economically disadvantaged throughout their lives.

Outcome 2: Teachers are imported to fill the positions left vacant by the failure of local students to take up teaching as a career. There are similar teacher shortages in Western countries, and non-Western teachers are likely to lack familiarity with the language and culture needed to teach students how to meet the challenges of the knowledge-based society.

Outcome 3: The requirements and standards for teaching are "dumbed down". This would allow inadequately qualified people to teach, lowering standards and quality. A variation on this theme would be a further lowering in the requirements for pre-service teacher education courses in an attempt to fill quotas and retain government funding.

All of the above options would be restraining forces and deleterious for public education in WA.

SCENARIO 2: THE HIGH ROAD OR THE CASH COW MODEL

Government invests some of the windfall from the resources boom in public education. It attract- high quality students to the profession and funds high- quality research-based pre-service teacher education courses. Government recognises that a good public education system with well-trained teachers in all classrooms is the backbone of a successful society.

Outcome 1: Scholarships are offered to fund the tuition and living costs of pre-service teachers. These attract bright school leavers and matured-aged students to the teaching profession. These scholarships could be linked to a "bond" system that required recipients to work for the government for a specified period or repay the "bond". This strategy worked well in the 1950`s and 1960`s over coming the teacher shortage and attracting high-quality students to the teaching profession.

Outcome 2: Government and industry invests heavily in teacher education through public private partnerships (PPP`s). Teacher education facilities have the funds to invest in the newest technology and research to improve courses. An example of a PPP can be seen in "The school of the future" a join funded project between Microsoft and the school district of Philadelphia USA, in this collaboration a model school for the 21st century incorporating integrated learning areas, authentic tasks and research-based teaching methodologies in a technology rich learning environment.

Outcome 3: Government adopts a model based on workplace learning (WPL) in which the students are paid for the work they do as teacher assistants as part of their training. In the WPL modules action-learning allows students to engage in authentic rich tasks based on research and reflection. This model integrates research and theory with practical classroom experiences. It helps schools by providing more collaboration in classes; it helps pre-service students by giving them valuable hands on learning experience; and it helps existing teachers by giving them opportunities for

professional development through taking on leadership enhancing mentoring roles with the students. This model is complemented by a shortened period of academic studies in which compact courses are delivered using the newest and most efficient web-based digital technologies. These enable academics to deliver high quality teaching incorporating video footage of real classrooms with input international experts in the field delivered online to students based in real classrooms. Learning materials can be accessed, by the students from any location at any time. Ipods and laptop computers are become essential learning tools.

Optional, direct teaching components can be included in the students` local areas for dynamic, researched-based workshops. One result is that students can be located countrywide, or even worldwide as they do practical components under supervision in local schools. This will ease some of the shortages of teachers in rural and remote areas by allowing students to complete their teacher education courses while doing WPL in country classrooms. This will increase the market of courses, generating national and international income. This model would also increase the attraction of these courses for mature- aged students who cannot be on campus for four years of full time study.

CONCLUSION

There is a crisis in pre-service teacher education. Unless education authorities recognise that the market has changed, and modify their behaviour accordingly, they will face a serious shortage of teachers in the near future. There are at present large cash surpluses available to government as a result of the resources boom. Some of these funds should be invested to build the infrastructure and capacity of our teacher education system. Government funds could also be used to offer generous scholarships linked to tenure and so attract students. Government should develop joint undertakings between the private sector and public schools to promote partnerships and restructure our pre-service teacher education courses.

We must avoid the forces resistant to change as presented in the "Crisis Model", which entail maintaining the status quo, and "dumbing down" the entrance requirements and qualifications needed to teach. Government fiscal policies are currently forcing Universities to retrench valuable experienced staff to save money. This provides only a short-term gain and will not build capacity to meet the challenges of globalisation.

The State and Australian Governments need to work together to bring about necessary reforms. The latter could avert the crisis with a swift injection of funding for Universities to reverse recent downsizing and under-resourcing of education faculties. Academic staff should be encouraged through funding to be innovative and to develop ways of teaching using technology to deliver courses in different modes. By using the resources boom positively, investing in research, technology, training and quality staffing for teacher education, the governments would be investing in the future, enabling Australia to meet the challenges of globalisation and the knowledge-based society.

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At this point nearing the end of this portfolio, which contains my learning and thoughts over the past four years. I am beginning to think in wider context looking more generally at the future training of teachers. My studies in the coursework unit EDU7104: Education and the Global Economy acted as a catalyst for the writing of this paper which uses futuristic techniques to develop scenarios of future education systems for pre-service teachers. Although I have situated my work in the West Australian context, the futuristic techniques used, the ideas about flexible modes of teaching and innovative use of technology to accommodate the learning needs and styles of students is more widely applicable to tertiary education planners in all sectors. This paper is currently under review for publication in The Australian Journal of Teacher Education.

5.2 Using Causal Layer Analysis and Morphological Analysis to Develop a Digital Education for Teachers

Abstract: This paper is written in reaction to promises made by the newly elected Labor government in Australia to deliver a digital education revolution. These are noble claims yet the current reality is that there is a crisis in education in Western Australia with a severe shortage of qualified teachers. The concern of the author is that for the digital education revolution to happen it will take more than putting computers into classrooms. Computers cannot teach therefore we need to begin the process by producing a future workforce of highly skilled teachers able to use the new technologies to deliver a world-class education system. To make this happen we need to engage in careful future planning in the tertiary teacher education sector. This paper utilises future planning techniques, such as causal layer analysis and morphological analysis to develop visionary scenarios of the nature and structure of tertiary teacher education in Western Australia in the future. Although the subject of this paper is planning for the future in tertiary teacher education, the techniques used may be useful for planning in other fields of higher education.

Introduction

The Federal Minister for Education in Australia, Julia Gillard has recently written to all Australian secondary school principals inviting their participation in the Rudd Government's $8 billion Digital Education Revolution. The government claims that;

> The Digital Education Revolution will dramatically change classroom education by ensuring that all students in years 9 to 12 have access to information and communication technology. The Rudd Government believes that every Australian child deserves a world-class education. To be able to compete globally, Australia needs a world-class education system (Gillard, 2008).

Although these are noble claims the author feels that we should take this opportunity to first examine the fundamentals of our education system, our teachers. This is currently an area fraught with problems in Australia many of these problems are entrenched in the system and will be difficult to fix. Yet an area with a huge potential for transformative and creative thinking is the training of our future teachers. This paper presents a number of future scenarios as food for thought on how we can do things differently to ensure we have the teaching workforce in the future ready to deliver the proposed digital education revolution.

Recent research undertaken by Leigh and Ryan investigating productivity and learning outcomes in Australian schools linked to spending per child reported a decrease in productivity of 12-13% as measured by average test scores despite an increase in expenditure per child (Leigh & Ryan, 2008). In my experience as an educator and avid supporter of technology in education it takes more than providing access to technology to provide a quality educational system. A vast body of research tells us that the quality of the teacher is the most significant factor impacting on educational outcomes in the classroom (Brophy, 1986; Darling-Hammond, 2000; DfEE 2000; Hattie, 2003). Leigh and Ryan note in their findings a link between falling teacher quality and student performance.

> If a 10% reduction in real teacher salaries reduces student performance by more than 10% then falling salaries could lower school productivity (Leigh & Ryan, 2008).

Currently in Western Australia for a number of reasons we have a serious teacher shortage. The University where I work is the largest provider of teacher education in Western Australia and has one of the largest education facilities in Australia.

Unfortunately, over the past three years we have experienced a 20-25% drop in applications for our courses (Lane, 2008). As the co-ordinator of a large post-graduate course in Primary Education, I have had to engage in a critical rethinking of our service provision and policy directions for the future.

In the short term, the drop in student numbers has led to a shortfall in the universities funding from government. There is a need for educational leaders to think about how to fund and grow our services while keeping pace with local and global demands. However, to make changes in tertiary level courses requires forward thinking because changes of this nature are costly to implement and have far-reaching implications. As a tertiary educator and planner I needed to develop a future vision to enable me to begin planning courses to meet those needs.

Methodology

In this paper I use an eclectic approach to construct a scenario of tertiary teacher education in Western Australia in the year 2020. According to the Oxford dictionary the etymology of the word prediction is from the Latin "proe" meaning "before", and "dicere" meaning, "to say". In many areas of business, experts in the field use the available past and current data about international and global developments to make reasonable predictions of the state of the market in the future (Mc Shane & Travaglione, 2005). Developing a sound prognosis enables more informed forward planning, risk analysis, budget planning, resourcing and future development projects. Educational institutions can benefit by using these futuristic strategies to do forward-planning to accommodate the future needs of the market place.

The scenarios will be considered from a post-structuralist perspective. The predicted scenarios will be examined to see where tertiary teacher education would be positioned in a free market. Aspects of governance, funding, globalisation and the role of technology are discussed. A "SWOT" analysis is conducted to reveal strengths, weaknesses, opportunities and threats. The weaknesses and threats revealed can provide guidance for the development of safeguards if the predicted scenario comes to fruition.

Initially I conducted a search of the literature looking at new models of tertiary education particularly the development of the Bologna Process (DEST, 2006; EUA, 2005; IRU-Australia, 2006). The Bologna Process is a current initiative by Tertiary Education bodies in the European Union to plan a more unified tertiary sector. Melbourne university has used this model as a basis for reconceptualizing its` courses. The paper is also informed by literature on school reform and governance, particularly

the work on vouchers, school choice and funding (Caldwell & Roskam, 2002; Clausen, 2006; Etscheidt, 2005). Furthermore, current media, ABS statistics, journal articles and government reports inform the development of this paper on issues relating to globalisation, funding and teacher education (Fitz, 2002; Goldstein, 2004; Hartocollis, 2005; Joseph, 2006; OECD, 2001). This informed the content used by the author when constructing future scenarios. The process in which the scenarios were developed will be described below.

Data is collected by the author using environmental scanning (Ritchey, 2005). This is a predictive strategy utilising multiple sources of data from Australian and international sources. The data is tabulated and then cross analysed using a field matrice, this can be seen in figure 2 further in this paper. The field matrice was used to generate morphological analysis. Morphological analysis was developed by a Swiss astrophysicist, Zwicky, as a way of structuring and investigating complex sets of relationships which are difficult to quantify (Richey, 2006). Zwicky developed a layered matrice known as a "Zwicky box" in which parameters are plotted across fields to consider contradictions, inconsistencies and eliminate unworkable variables in the data (Inayatullah, 2006). There are a number of ways of doing the cross-consistency analysis. In this research a method was used where each scenario is related as a whole to the parameters. This methodology of morphological analysis is used in the United Nations University Millennium Project for futures research (Ritchey, 2005).

A further technique called causal layered analysis was also used to broaden perspectives in the development of scenarios. According to Inayatullah (2006) CLA is used to develop transformative spaces for the creation of alternative futures.

> Causal layered analysis consists of four levels: the litany, social causes, discourse/worldview and myth/metaphor. The challenge is to conduct research that moves up and down these layers of analysis and thus is inclusive of different ways of knowing (Inayatullah, 2006).

This technique was used by organizations such as UNESCO at the World Future Studies Conference in Thailand in 1993 and Southern Cross University Australia in 1994 (Inayatullah, 2006). CLA works within a post structuralist paradigm in that it incorporates the importance of the social and cultural perspective in framing the interpretation of the information. CLA uses four interconnected layers of discourse to shape the scenarios. The first layer litany, explores quantitative trends and problems to create a current picture. The second layer considers social causes related to the situation and analyses economic, political and historical factors. In the third layer the structure

and discourses surrounding the situation are considered. It is in this layer that deeper social influences and cultural structures are integrated into scenarios. The fourth layer goes beyond the surface analysis to work on a deeper level exploring metaphors and symbols to create the vision and underlying philosophy of the envisaged future system; In this layer it is possible to go beyond the conventional, engaging in creative visionary notions in this case of a new system of tertiary education for teacher education.

Scenarios are widely used as a predictive strategy. They were used by the Organization for Economic Co-Operation and Development (OECD) in the 1996 Ministers conference in Paris where a number of scenarios for schooling over the next two decades were developed. The scenario approach was also used at OECD Conferences in The Netherlands in 1998, France in 1999 and Rotterdam in 2000, as well as the "L`ecole Horizon 2020" *The school in 2020* Conference in Paris (OECD, 2001). Guidelines for creating scenarios can be obtained from the work of organization strategists who have worked with organizations such as Shell, The South African and the Canadian Governments (Kahane, 2001; Senge, 2001; Van Der Heijden, 1996).

At each layer in the construction of the scenario a "swot' analysis is conducted to consider the strengths, weaknesses, opportunities and threats imbedded in the scenario and recommendations are made about necessary safeguards. In the follow section the current context shaping the tertiary education market in Australia is described because this context will have implications for future planing in this sector.

Setting the Context: Tertiary Education in Australia

Tertiary education is currently a highly regulated area in Australia but there is growing pressure to deregulate and move towards a free market system, which is known as marketisation (Levin & Belfield, 2003). Australian tertiary education has become a priority area for the expansion of private and international tertiary providers. There are currently a number of international private education providers wanting to establish facilities in Australia because of potential advantages of positioning courses in Australia. For example, Australia is seen as geographically well positioned for off-shore campuses for American and European universities wanting to serve the Asia-Pacific market. Other advantages are that instruction is in English and the infrastructure and technology access are good.

These economic factors in Australia have prompted major policy initiatives on tertiary education in the global political area. The National Competition Policy, states

that government businesses are subject to market forces and competition (COAG, 1995), this means that markets are no longer localised and protected. The Multilateral Agreement on Investment and the General Agreement on Trade in Services (GATS) are changing the way higher education will operate on a global level (Education-International, 2006; EUA, 2005). When the GATS agreement gets fully endorsed, subsidies for Australian institutions and students will become increasingly difficult if not impossible unless those subsidies are made available to foreign businesses operating in Australia. At the World Trade Organization (WTO) meeting in Hong Kong in 2005 industrialised countries put pressure on other nations to open the higher education sector to international competition and liberalise the market (Education-International, 2006; WTO, 2000). This increasing global economic market pressure means that only the strongest and most viable providers will survive. The Bologna agreement will now be discussed from the perspective of its potential impact on future planning for Australian Universities.

The Future Global Impact of the Bologna Agreement

The development of the Bologna Process, which commenced in 1999, would seem to have much relevance for the future of Tertiary Education in Australian and the Asia – Pacific Region (DEST, 2006; EUA, 2005; IRU-Australia, 2006). The outcome of the seven-year Bologna Process is that universities in 45 countries in the European Union will have common courses and a common certification and quality framework. As a consequence there will be equality and compatibility between the different tertiary institutions in the European Union.

In 2006 the then Australian Federal Minister of Education hosted a conference in Australia with the leaders of the tertiary education sector in the Asia-Pacific Region (DEST, 2006) with a view to using the Bologna agreement as a blueprint for the creation of a common path for tertiary education in Australia and the Asia-Pacific Countries (Armitage, 2006). But there has been criticism of the Bolognaisation of Australian Universities; the main fear is that universities would lose their identity and autonomy (IRU-Australia, 2006). However, the danger is that if Australia does not align with the changes proposed in Europe, courses offered here will not be accredited and therefore not attractive to foreign students and local students who are planning to work for international companies. Furthermore, China has been granted observer status at the

Bologna Process planning meetings, which indicates their keen interest in these developments and could have implications for Australian Universities.

Tertiary Teacher Education in Western Australia

As mentioned in the introduction there are serious problems in tertiary teacher education in Western Australia. The university were I work is the largest tertiary teacher education provider in the state and one of the largest in Australia. We have experienced a significant drop in enrolments in our courses over the past four years. This had lead to a significant drop in government funding leading to widespread retrenchment of experienced staff. It has also lead to cut backs in innovative teaching strategies integrating new technologies into teacher education courses because of fiscal cutbacks. Teacher educators are under pressure to deliver high quality graduates who have the skills to drive a digital education revolution as proposed by the government yet currently we do not have any addition funding or resources to deliver this high level of technology rich education.

The government is proposing spending billions of dollars to put computers into school classrooms yet the teachers are not yet being trained in this resource rich environment. The author feels that to deliver a digital education revolution we need to start by investing in our future teachers and their education. By resourcing teacher education government will be investing in our future and building a firm foundation for a world-class education system. In the following section a range of future scenarios for tertiary education in Australia will be described.

The Tertiary Sector in Western Australia in 2020 Scenario 1

The demographic data indicates an aging Australian work force in 2020, with the percentage of the population not economically active increased to approximately 35-42% (A.B.S., 2003). This indicates the need for a reduction in funds for government projects, and a change in how tax funding is spent. And since the large number of voters who are over 65 would influence how tax funding is spent. The priorities could become health care and pensions, which could necessitate cost cuts in the tertiary education sector.

One method to reduce government spending on tertiary education would be to promote a more stratified tertiary system. The stratified system would be more cost

effective by concentrating research activities, which are costly, in few Universities and downgrading the status of other universities to teaching-only institutions. Arguably, this model was foreshadowed by the Howard government's introduction of the research quality framework (RQF) system in 2007. At present an active research program is a key defining characteristic for being a university (Attorney-General, 2006), so this stratification could result in many of the universities specialising in teacher education being downgraded to a previous era of teacher training colleges. Although this model indicates fiscal savings for the government in the short term, it could lead to a long-term decline in the quality of the tertiary teacher education sector. For one thing teaching only institutions would not attract international students. Furthermore, the lack of funding for research would deter many academics and lead them to seek work overseas or in other sectors.

Another option would be to move towards a more marketised model. Universities have already raised fees paid by students by 25% over the period 2005-2006. If these funding policies were to continue over the next twenty years a much more privatised tertiary sector would emerge. This approach is advocated in the work of Friedman and in publications by the Australian Liberal politicians (Friedman, 1993; Nelson, 2003). In figure 1 below it can be seen how student contributions to the cost of their education has increased on an annual basis under the previous Howard government. Students now pay 27.6% of the real costs of their tertiary education while under former Labor governments; free tertiary education was used as a way to build the nation.

Figure 1: Projected average student contributions as a percentage of total commonwealth funding for higher education institutions in Australia

Year	Total commonwealth funding for operating purposes	Total actual student contributions	Average student contribution towards the cost of education
2001	$5.3billion	$1.4billion	26.1%
2005	$6.4 billion	$1.7billion	26.8%
2008	$7.7billion	$2.1billion	27.6%

Data from The Higher Education Support Act 2003 (Attorney-General, 2006)

Figure 2 shows a table summarising the causal layer data. This table was developed from a review of the literature and policy documents to indicate quantitative trends and problems in higher education sector impacting on teacher education. This part of the causal layer data analysis process leads to the development of a range of scenarios. The table highlights some of the potential impacts of the previous Howard Governments policies on tertiary education.

Under the funding column it can be seen how the aging population will influence the tax base and the distribution of government funds. The reduction in funding to the tertiary sector will impact on teacher education in a number of ways these are included in scenario 1 the development of a stratified education system. This type of system will have many potential weaknesses for teacher education as outlined in the table below. Ultimately it will not stimulate growth and creativity in the tertiary teacher education sector but would downgrade the status of teachers as teacher education faculties could be turned into training colleges for non-degree status programs which are cheaper to fund.

Figure 2: Causal layer analysis 1st layer litany- quantitative trends and problems.

Funding	Consumer behaviour	Impact on education	Market Paradigm	Features- Scenario 1 2020	Weaknesses in a stratified tertiary education system
*Diminishing- government *Aging population demographic (ABS, 2003) * *Smaller percentages of the population who are economically active to fund state funded ventures. *Lower economic output per capita Voters priorities *Spend money on pensions and health care. *Aging staff in tertiary education *Enrolment figures down tertiary ed * Higher HECS fees	*Students have little choice- University place determined by quotas and TER scores for courses- *A few full fee paying places. * Generation Y students not attracted to the teaching profession *Economy strong, many jobs available, providing little incentive to study further	*Change in funding 25% increase in fees *User pays system. HECS/ FEE HELP *Fall in demand for tertiary education * Reduced funding for capital intensive projects- new technology	*Health care i moving in the direction of a more privately funded sector. *Schooling moving towards more private provision *Complex funding system linked to governance and control by State and Federal Governments *Poorly resourced sector less attractive to students *University degree is expensive	* Save money by the development of a stratified higher Ed system *Research Quality Framework (RQF) Research Universities vs Training colleges (cheaper to fund.) *Accreditation –rigid- will not accredit qualifications from other states and countries * Based inflexible- quota system- layers of Federal control- Commonwealth funding quotas unfilled in many courses yet not enough places in other courses	*Not compatible with Europe/ Asia? *Expensive for Government to fund *Lose top academics to research orientated universities * Poor staff profile *Failure to attract international students and high achieving local students *Lack of research will not attract grants and funding which can supplement Universities funding *Loss of top academics in teaching institutions leads to decline in quality of teaching not research based *Decline in research output as research linked to teaching declines

An overview of the socio-political influences on tertiary teacher education in 2020

To develop an overview of the economic, political and historical factors influencing the tertiary education the writer developed a table to summarise data in the 2nd layer of CLA. This table was used to construct another future scenario. Much of the current literature on education, economics and globalisation heralds the twenty first century as an era of rapid change and innovation (Goldstein, 2004; Hargreaves, 2003; Mc Shane & Travaglione, 2005). According to systems theory and globalisation there are many layers of interactions and interconnections between countries and economic systems. These shifts and changes in one level of the system will have ripples and repercussions around the globe. It is an era of global co-operation and agreements, but paradoxically in many sectors there is fierce competition for market share and survival.

As indicated above, the strengthening of the European Union and the rising power and rapid growth of China and India are economic realities that are bound to influence growth in the Asia Pacific Region. The growth of liberalism across the Western world has initiated changes in ideology, governance and funding models

(Ryan, Parker, & Brown, 2003). For example, local markets are no longer protected and there is global economic market pressure, with only the strongest and most viable surviving.

Australia has a federal system of government, with layers of governance and control at both state and commonwealth levels. For the past ten years the Liberal Coalition controlled the commonwealth government, while the Labor Party controlled the State Governments. This led to conflicts of power and problems in governance yet had a moderating influence on individual party policies dominating any sector. The pendulum had now swung with the Labor party winning in the 2007 federal election. It will be interesting to see what changes take place in governance and funding of the tertiary sector.

Currently market pressures are dominating change in the higher education sector. This has resulted in both Labor and Liberal parties having similar policies. Globally, liberal democracies in recent times have made a shift to the right, with conservative ideologies dominating policy (Ryan, Parker, & Brown, 2003). There are moves by both sides towards liberalising markets and allowing free trade policies. For example, the Labor party recently reversed its position of cutting funding for private education; thus both parties are supporting the growth of private schools. It would be reasonable to assume that both parties will also encourage the development of more private tertiary education providers. Private Universities have been operating in Australia for the past twenty years. A recent development was the extension of low interest paying loans to students at private universities. In figure 3 below a table summarises the 2nd layer of CLA data examining socio-political factors impacting on teacher education in Western Australia

Figure 3: A matrix summarising causal layer analysis data, 2nd layer socio- political factors

Funding	Consumer behaviour	Impact on education	Market Paradigm	Features- Scenario 2- 2020	Weaknesses
*Socio-political framework based on globalism *International market pressures. *The Development of the European Union. *Australian politics- move further to the right, free market system * Economic rationalists- Thatcherism/ Reganism	*Consumers wanting more choice. *International market- more competition- *Strong Australian Dollar- increased costs for International students *Competition from Europe *Poor consumers- *Lack training *Development of an under class- social hierarchies	*International student-market. *Challenges by tertiary providers in Europe * Australia- moves to free market-user pays system *Growth of Private Universities.	*Need to market globally *Be more competitive- Quality, price, courses *Tertiary sector needs to be compliant with Bologna for international accreditation. *More choice private Universities for profit /not for profit	Scenario 2- *More use of technology- *Competitive quality assurance- *Economically Competitive- *Internationally attractive- Access- Asia-Pacific market *Move to a fully privatised user pays model *Rich can buy a degree of their choice	Weakness- *Local market suffers *Social equity issues lead to stratified society *Are all courses culturally transferable *Language issues- costs of translations * 2nd language teaching lower standards *Strength of the dollar Global recession? *Quality assurance- academic integrity *The student as a client buying a degree, conflict of interest

Socio-Political Factors and Safeguards for Future Scenarios

If a fully marketised model were to emerge by 2020, there would need to be safeguards. A fully marketised model would require that national and local barriers to participation by private providers be removed, allowing a "level playing field" for all tertiary education providers both Australian and International. This could lead to the demise of non-competitive providers and to the establishment of monopolies, such as in the area of childcare, with a private company listed on the stock exchange, but this could have dubious outcomes for the sector (Australian-Government, 2006; Brough, 2006; Clausen, 2006).

Since private companies are answerable to their shareholders, and their priority is to make fiscal profit, this could lead to a diminishment of quality and academic integrity. There are also social factors to consider. Not all tertiary education courses are profit making, and a non-marketised model allows the use of cross subsidies for unprofitable courses that are for the common and social benefit. A marketised model could privilege certain sectors of the population, leading to the development of a more stratified society and the growth of an untrained underclass. For example, when this occurred in South Africa under the apartheid regime, which advocated cost recovery for educational services, it created social unrest and a crime-ridden society.

The Value of Public-Private Partnerships (PPP`s) in a Semi-Marketised Model of Tertiary Teacher Education

In scenario three the model of private-public partnerships is developed by government working jointly with private providers. This is in line with ideology of Liberal Democrats in the UK the "3rd Way" of public-private partnerships as seen in new health care models in the United Kingdom (Fitz, 2002), and the charter school movement in the USA. Charter schools are schools that are funded by the state yet run by private companies to operate more efficiently (Goldstein, 2001). Caldwell and Roskam (2002) describe advantages of such a system in which academics focus on teaching and research, and administrative functions are outsourced to private providers. In education this could take the form of partnerships with schools, which are used for workplace learning and practical teaching.

A possible funding model for tertiary education is the voucher system. The cost of tertiary education would be calculated per capita and this would go directly to the student in the form of a voucher (Caldwell & Roskam, 2002). In this scenario the market forces would determine the size of courses and institutions. The ideal would be that undergraduate education would be fully funded by government, in keeping with current the interest of both Liberal and Labor parties. From a Liberal Party perspective a well-trained labour force would lead to economic growth. From a Labor Party perspective the government funded voucher would have social equity benefits and be for the common good of all. This system could be supported by low-interest loans to students for postgraduate study. As part of this model, more online courses would be offered to attract those working full time or with family obligations. Figure 4 shows the 3rd layer in the causal layer analysis, which considers the structure and discourse of tertiary education and introduces a semi-marketised model of private-public partnerships. In figure 4 universities are working with business to provide a market responsive model for delivering teacher education. In this way economic models of efficiency are introduced injecting more funding into the sector. The provision of vouchers to students to be redeemed at an institution of their choice brings consumer choice into the educational sector. This competition could raise standards making universities more competitive. This could also stimulate the use of technology to deliver courses to international markets.

Figure 4: A matrix summarising causal layer analysis data, 3rd layer- structure and discourse

Funding	Consumer behaviour	Impact on education	Market Paradigm	Features-scenario	Weaknesses
*International trends- USA, UK-3rd way * PPP~S private public partnerships	*Students select a university and course of their choice *Increase in international students	Semi-marketised	*Voucher system- *Credits-for basic under grad courses *Non interest loans HECS-higher degrees	Scenario 3- *Resistance-traditional players- demise of non-competitive providers. *Universities use technology to access new international markets * Provision of online courses to attract more students who are working full time * Universities run more efficiently in partnership with private providers	Weaknesses * Getting aging electorate to fund tertiary under Grad Education * Free market principles no cross subsidies for courses needed for social good *Who pays for services for weak students, learning disabilities, Indigenous students? Who pays for additional services councillors, academic support?

A future scenario for teacher education integrating digital technologies

The scenarios developed from the 3rd layer of the CLA process show a future picture of teacher education, which looks quite different to the current model. The main differences would be the incorporation of innovative uses of technology and more flexible, cost-effective modes of teaching. These will be extended and further described in the fourth layer of the causal layer analysis model. This layer uses metaphors and symbols to extend the scenario. The 4th layer of analysis has generated metaphors like seamless, digital, high tech, learning communities and customised delivery.

The rapid growth of technology, particularly wireless digital technology and high speed internet connections, are changing the way we communicate and do business (Pink, 2005). There are current plans to extend broadband networks to remote areas in Australia so it would be reasonable to assume that by 2020 high-speed Internet access will be the norm for all areas. The expectations and learning and thinking styles of students exposed to these technologies puts pressure on academics to change the way they teach. Current research undertaken by the author gathering data from teacher education students on their learning needs and styles indicates that students want more flexible delivery of course materials and more use of new technologies in courses (Lane, 2005, 2007). To implement these technologies could require partnerships with private providers who have expertise in these fields.

Figure 5: A matrix showing the 4th layer causal layer analysis generating metaphors

Funding	Consumer behaviour	Impact on education	Market Paradigm	Features-scenario Scenario 4-	Weaknesses
Public /private partnerships – *Scholarships- private schools fund future teachers *Government schools scholarships in exchange for working in areas of need *Learning community-involvement-innovation-apprentice ship models Post modern context *Technology based society	*Students demand flexible options *Suit my learning needs and styles *Digital generation *Workplace learning-online components *Buy the best	*Public Private partnerships *User pays free market *High quality- *Government funding in the voucher system- to the user redeemable at accredited universities-payback linked to years of work in the system	*Free choice *Government credits-vouchers *International credit transfer system to align with Europe-	*Seamless, flexible, digital, high-tech, globalised * New conceptual basis for pedagogy- learning communities-beyond classrooms *Online, catering for learning styles and needs *Customised, market orientated, outcomes-based *Public-private partnerships- *Apprenticeships-workplace learning	Challenges by traditionalists threatened by change *Lack of technological skills needed to teach in this system. *Costly technological infra structure/ technological support/ staff training *New conceptual basis for pedagogy *Challenge to layers of governance and power *Move power and control to users of the system, public and market place

The predicted scenario: A public-private partnership model "A seamless digital learning community" for teacher education in WA in 2020.

The prediction is that market forces would reshape the tertiary educational sphere. Public- private partnerships would be developed alongside privatised education providers with global accreditation. Governance would be at a global level, with professional organizations providing accreditation to tertiary institutions. There would be a tertiary voucher scheme allowing users to redeem their voucher at an institution of their choice anywhere in the world. This marketised model of user choice would transform the tertiary sector, as we know it today.

Advanced digital technology would allow seamless access to courses from anywhere in the world. Courses would be marketed internationally and tertiary institutions would need to develop specialised niche markets to maintain their market share. Public-private partnerships would provide practical teaching experience and supervision. Students would use advanced digital video technology to video their teaching on their mobile phones or other portable communication devices. This is already possible on the G3 network. They would use online portals to digitally analyse and reflect on their teaching. This video analysis would be sent online to their tutors. All texts would have online portals with video components to visually illustrate teaching techniques and strategies. Lecturers would use video conferencing to create a seamless digital learning community.

Courses would be outcomes based not input based as in the current model. In the outcomes-based model students would be credited for teaching experiences and courses completed so that courses of study can be completed in flexible timeframes to suit the levels of experience and previous learning and work experience of the students. This would differ from current courses where only inputs, such as the number of years of completed in fulltime study, are accredited. There would be more postgraduate courses at a master's level as people move between careers to be more marketable.

Lecturing staff would be more flexible using voice over internet protocols (VOIP) and video streaming and enhanced podcasts to virtually connect with students in study centres across Australia and Internationally or in the students' homes using the internet. Virtual portals for example Second life can be used as hosting platforms for public lectures and interactions. These study centres both real and virtual can be privately owned and form part of the PPP`s (Private-public partnerships). Physical university buildings and teaching venues may not be needed students for every interaction; this would reduce costs and need for more physical infrastructure. Those essential core campus buildings would be managed by professional companies maximising on efficiency, as seen in the Charter School movement in America. This would save money on unproductive use of current teaching space. More courses would be delivered in mixed modes, with a combination of workplace learning, online work and, if needed, intensive blocks of face-to-face tuition.

The global accreditation system would allow students the flexibility to select courses that suit their learning needs at an institution of their choice. Students would not have to complete a qualification at any one institution. There would be more partnerships between institutions, with courses being offered collaboratively between universities so that materials and teaching expertise will be shared.

Weaknesses of this model are that not all content is culturally transferable. In a multicultural society like Australia some cultures could be marginalised, for example indigenous students. In a global context certain values and learning can be culture specific. Care would need to be taken that dominant cultures do not supersede local cultures. Thus course content may need to be adapted to meet the needs of the learner and the local community.

The validity of the prediction

All predictions contain elements of truth and elements of conjecture because there are many variables that can influence society in the future. In this scenario steps have been taken to give a level of validity to the final scenario. National and international data sources were used in constructing the prediction. Expert sources in the area of future strategising were consulted in the construction of the scenario (Boomer, 1992; Carnegie-Mellon, 2006; Commonwealth-Australia, 2007; Department of Treasury and Finance, 2007; Spring, 1998; Thurow, 1997; Young, 1998) . The final scenario is in line with current trends and international policies on tertiary education. Shown below is a "Zwicky box" in which parameters were cross analysed (Inayatullah, 2006).

Figure 6: Morphological Analysis using a Zwicky Box

Scenario	Features of tertiary ed system	Educational Features	Market Paradigm	Quality assurance	Governance
Global crisis	No Uniformity- courses credits Qualifications	Courses not compatible- Not recognised in other areas	Different levels of funding fully funded- private	Varied- levels of quality	Varied/National/ State/ private/ Business/ shareholders/Industry
Current policies in WA	Rigid stratification of tertiary education sector	Input based -Length of course	Strict quota system- User pays- HECS-fee help	Government controlled. AQUA	State and Federal governments layers of control, WACOTT professional association
Bologna process	Unified system 45 European Countries	Outcomes based	Flexible- transferable credits- still under discussion 2007 summit	Independent Quality control body- accreditation	Individual countries Global accreditation
Asia-pacific Rim	No unified system China- keenly observing Bologna process- Large market for education	Market orientated- value for money- competitive	Full fee paying international students in Australia Currently 32 000	No common system	Individual countries State controlled
International Situation	America/ Canada- no unified system yet Africa- no unified system	Input based	Full fee paying	Will currently accept Australian Qualifications for some courses in some states	USA- private universities, for profit/ not for profit. Move towards standardised accreditation- common examinations for Teacher Accreditation
Predicted scenario in WA 2020	Seamless system Global accreditation	Outcomes based- high tech- digital- online- globally accessible	Full fee paying with government vouchers from country or state of origin Private public partnerships	External, independent accreditation agency. Provides certification for courses	A number of layers of governance- global- linked to accreditation quality assurance- national, state- individual consumers- profession- professional bodies

Conclusion

In this paper a range of future scenarios are presented in response to the challenge faced by tertiary educators to prepare teachers for the digital revolution. The author supports the current governments' vision of a digital education revolution yet the author proposes that to achieve this we need to look beyond putting boxes into classrooms. Both government and academics need to take a serious and transformative look at the key resources to deliver the revolution, our teachers. If we continue along the current trajectory of reduced enrolments in teacher education courses, inadequate funding to deliver high quality for teacher education, and models of delivery that are very similar to those used 100 years ago we will not be able to resource the vision.

There are many challenges facing tertiary teacher education in the future and it is beyond the scope of this paper to address them all. In this paper I have proposed that futuristic techniques can be of value in getting government and educational planners to consider options and be more flexible in their planning and thinking. The rate of change in our current era is rapid. The funding and structure of our current system will not be sustainable or able to deliver the world-class education system we will need in the future. We need to think of ways of doing things more effectively and affordably while maintaining the market share. As educators we need to move with the times or risk becoming obsolete. New technological advances are occurring on a daily basis, yet much of tertiary education is continuing as it did over 100 years ago.

International political changes, like the end of the cold war and the rise of China and India have led to changes in ideology held by governments in Western democracies. These are leading to changes in governance and funding models. As potentially influential players and decision makers shaping the future of tertiary teacher education, we need to be mindful of the words of Mintzberg (1996) who proposed a situation of balance. " Successful democracies have operated on the basis of strong government supported by strong partnerships with business" (Minzberg, 1996).

Finally, some words of caution: we do not want to be in a position where education becomes a commodity to be bought and sold by the highest bidder or the richest student. The future of our children and future society are shaped by the quality of the teachers we train. This is too valuable and strategic to be left entirely to market forces. Education is a way of transmitting our national culture and values. There is no one-size-fits-all solution. We must not allow our academic integrity to be undermined by purely economic pressures. We need to be able to attract and select the best

applicants and control the quality of our future teachers. Above all we need to be in a position to deliver the best quality education to our students. A good education is the right of all our students and is necessary in building a strong, successful society.

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CHAPTER 6

Conclusions

Ch 1 Introduction	Ch 2 Lit review	Ch 3 Research Phase1 Teachers	Ch 4 Research Phase 2 Preservice Teachers	Ch 4 Research Phase 3 Post Grad Students	Ch 4 Research Phase 4 Technology in teaching	Ch 5 Future of Teacher Education	Ch 6 Conclusion

Figure 28: Portfolio progress chart chapter 6

The final chapter includes a brief overview of the portfolio and discusses the research undertaken in the four phases of the portfolio. The following section describes the outcomes of the research. Then the recognition given to the work produced as a result of this research within the university and in the wider community was detailed. Next the significance and implications of the study were discussed, concluding with recommendations for further investigation and practice.

6.1 Study overview

This portfolio entitled, "Preparing tomorrows` teachers today", traces the journey of a teacher educator over the past five years. In chapter one the theme of the portfolio was introduced, investigation of areas for potential change in pre-service teacher education. Chapter two presented a literature review of selected areas of learning, cognitive science, brain research and theories of learning, highlighting the significance for teachers. Further in chapter two the nature of a new curriculum framework in Western Australia was explored.

In chapter three, research was undertaken with teachers, to determine their current learning needs and their thoughts on the usefulness of theories about learning styles and multiple intelligences for teachers. The learning journey of the author continued to consider what changes we need to make in pre-service teacher education courses to meet the learning needs of current pre-service education students and to prepare then to be educators of the future. This was described in phase 2 of the research. In phase 3 data was gathered on the needs of post-graduate students, particularly their need for further learning in the use of technology to help them face the challenges of integrating technology into their teaching. Phase 4 discussed the integration of new technologies in pre-service teacher education courses. Chapter five considered problems in the current system of teacher education as well as the social and political factors that

impact on teacher education and proceeded to develop future scenarios of how we can build a vibrant relevant teacher education system.

6.2 Outcomes of the research

There were a number of outcomes of the research work undertaken in this portfolio. The conclusions of the literature review revealed significant information that needs to be included in teacher education courses. For example, the new information about the nature of the brain, brain development, the importance of metacognition in learning, neural plasticity and distributed cognition have now been included in new courses for preservice teachers designed by the author. The finding of the research in chapter three with teachers lead to the researcher conducting a series of professional development opportunities called "Brainworks" with teachers in which a professional development package was developed by the researcher to address the learning needs indicated by teachers participating in the study.

The investigations with pre-service teachers in chapter three, culminated in the reconceptualisation of a core unit for pre-service teachers called " Becoming a more effective learner." In this unit pre-service teachers were guided through learning about current theories of learning. The data collected from the first year students about their learning needs and styles and preferred ways of engaging with course materials resulted in the innovative design of a tertiary unit using technology and flexible modes of delivery to suit the preferred learning styles of Generation Y learners.

The research was undertaken with post –graduate students to determine the learning needs and styles of more matured aged students, revealed large gaps in their use of and understanding of technology with over 90 % of the students requesting further learning in their use of technology. This served as a catalyst for further design changes to post graduate units to incorporate more technologies, for example podcasts and digital learning objects. These flexible delivery modes were used to model appropriate uses of technology to the students and allowed students to customise the unit content to their level of understanding.

These changes to the design and modes of delivery of these tertiary units of study represented a fundamental shift in my thinking about the nature of learning and the role of the learner and the role of the tertiary educator. As a result of the work undertaken in this portfolio my teaching has moved from being in a transmission mode where the academic delivers learning materials to the learners to more of a constructivist mode where the academic works with the learners who are active

participants engaging, researching and exploring knowledge and concepts while developing a deeper understanding of their own learning potential.

6.3 Significance and implications

The qualitative responses from teachers on questions dealing with the theoretical aspects of multiple intelligences and learning styles revealed high levels of confusion among teachers with no common vocabulary for describing ways of learning and learning processes. Thus the teachers in this study were indicating that they felt these theories and understandings about learning were important for teachers, they believed that knowledge of these theories would make a difference to the learning outcomes of students in their classes but that these topics had not been covered sufficiently in their teacher education courses or in subsequent professional learning. This has implications for the planning and design of courses for pre-service teachers as well as indicating a need to provide ongoing high quality professional development for teachers to keep them current with new research.

The investigations into the Curriculum Framework in Western Australia showed that this new curriculum expected teachers to have high levels of professional knowledge about learning and learning theories as this curriculum emphasised the learning processes, metacognition and learning outcomes as opposed to previous content based curriculum this has implications for the selection of content for pre-service teacher training in Western Australia to equip then to deliver the changed curriculum in schools.

6.4 Recognition of the work in this portfolio

I am currently the leader of The DEEWR ICT Project. This project with a budget of over $ 100 000 in 2008 uses a range of strategies to encourage academic staff in pre-service teacher eduction to incorporate ICT in their teaching. In March 2008 I was awarded a Vice Chancellor`s Citation for Outstanding Contributions to Student Learning for " Leadership in ICT by developing and successfully integrating a range of innovative technology-based resources into teaching to enhance student learning and engagement." This award by the university acknowledges the impact of the reconceptualisation of my teaching, which was an outcome of the research and development work in this portfolio.

I have been nominated for a National Carrick Institute Citation for Excellence in teaching for the work I have done integrating technology in teacher education courses.

This work was also recognised by the Faculty of Education and the Arts who presented the author with an award in January 2008 for Leadership in ICT acknowledging the importance of this work in pre-service teacher education, which emerged from the research component of this portfolio. The work in the portfolio has also been recognised by the broader community though the publication of five peer-reviewed papers in academic journals. One of the academic conference presentations included in this portfolio "Digitising our learning" (seen in section 4.12) was selected by The Department of Education Science and Training for the "Innovation stream" at The Australian Computers in Education Conference (ACEC) held in Cairns in October 2006. Academic papers on the research and work done as part of this portfolio have been selected for presentation as peer-reviewed at four conferences. One of the papers in this portfolio "Working smarter to improve the learning of large student cohorts using technology." (seen in section 4.15) was selected as a scholarship winner by Apple Computers in 2007.

The impact of the work resulting from the research in this portfolio in reconceptualizing courses for pre-service teacher education was also acknowledged by the students who presented the author with a certificate for "Outstanding teaching" in May 2006. This award was a result of recommendation from the students to the Student Staff Liaison Committee. The students also acknowledged the changes in pedagogy and course design which resulted from the work in this portfolio through consistently high the unit teaching evaluations for example, for the item "the lecturer organised the subject matter in a way that helped my learning" the received a mean agreement score of 94% for the item "The unit was engaging and interesting" the unit received a 92% agreement from the students, with an over all score from the students of 94% agreement for the item "I was satisfied with this unit".

In summary the work in this portfolio has been recognised and commended by fellow academics, the faculty, the university, the students, DEST, and the wider academic community and well as commercial agencies.

6.5 Recommendations

There are a number of recommendations included in the conclusions of each section yet an overall recommendation would be that the academic community, government agencies and all concerned with the future education of children in Western Australia need to continue to invest more time and resources in pre-service teacher education. It is vital for the success of our future education system for us to have well trained, high quality teachers in our classrooms. In reality we may not get more resources so we need to look at innovative ways using flexible modes of delivery incorporating new technologies to deliver an engaging relevant curriculum to equip tomorrow`s teachers with the skills they will need to teach in future contexts.

6.6 Conclusion

Preparing tomorrow`s teachers today is vast topic there are many areas that need continued research and development work. The times that we live in are marked by constant change and innovation so the challenge to teacher educators is to keep current with new research and innovation and to constantly update our courses, modelling best practice so that our future teachers receive the most relevant, cutting edge education.

The research conducted in this portfolio provides evidence supporting new curriculum for preservice teacher education courses. These new courses need to include the use of technologies as teaching tools to enhance student engagement and maximise effective use of teaching time. The technologies can also be used to do routine repetitive administrative tasks freeing the academics to use their time to engage with higher levels of student engagement and deeper levels of learning.

Preservice teacher education courses need to be constantly updated as scientific research provides new data about the brain, neural processing and the nature of learning. This research provides evidence to teachers of effective practice to maximise learning. Preservice teachers also need instruction on how to design their pedagogy to cater for the wide range of learning needs and styles of learners in the classrooms of the future.

Academics involved in preservice teacher eduction courses need to be modelling these technology rich, research based teaching strategies in their teaching of the teachers of the future.

Appendix 1

Questionnaire for teachers

EFFECTIVE LEARNING RESEARCH

My thoughts on learning.

A QUESTIONNAIRE FOR TEACHERS

The purpose of this questionnaire is to find out about the prior knowledge, beliefs and current understandings you hold about effective learning. Your answers are very important because the information collected will be used to help the researcher develop Professional Development materials suited to the current needs of teachers.

INSTRUCTIONS

There are 22 questions. Please answer all questions

What you say is completely confidential. You do not have to write your name on the questionnaire.

It will take about 5 minutes to complete.

Use a pen or pencil to clearly indicate your answers.

For each question, indicate your answer by ticking the appropriate box. Tick only one box.

When you have finished please leave the questionnaire in the envelope marked "Questionnaires for J. Lane" in the secretary`s office.

If you have any further questions or wish to know more about the survey please contact Jenny Lane on 08 9370 6207.

For each of the following questions tick the applicable box/boxes.

a. Gender

Male ☐ **Female** ☐

b. What is your cultural status?

Indigenous ☐ **Non- indigenous** ☐ **Ethnic minority** ☐

Other please specify .....

c. Teaching Qualifications

3 year trained ☐ **4 year trained** ☐ **Post Graduate Diploma** ☐

Honours degree ☐ **Masters degree** ☐ **Other .....**

d. Where did you undertake your teacher training?

WA ☐ **NSW** ☐ **ACT** ☐ **VIC** ☐

SA ☐ **QL** ☐ **NT** ☐ **TAS** ☐

Other please specify .....

e. Please indicate the number of years teaching experience you have

1-4y ☐ **5-10y** ☐ **11-15y** ☐ **16-20y** ☐ **20y+** ☐

f. Please circle in which year you attended professional development on current research in learning theories and brain research.

2007 2006 2005 2004 2003 2002 2001 2000 never

other

The following questions are about your prior knowledge, beliefs and needs in the area of learning theory. To what extent do you agree or disagree with each of the following statements. *Please tick one box for each statement.*

Past learning experiences						
		Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
1	My school teachers based their instruction on a knowledge of the different learning styles of the learners.					
2	I was made aware of my learning needs and style at school.					
3	My learning style was not catered for when I was at school.					
4	At school I was given a range of strategies to help me learn more effectively.					
5	During my teacher training I received sufficient training on how to determine a learners learning style and needs.					
6	During my teacher training I received sufficient information on current research on brain development and its` implications for teachers.					

My own learning style
is.....
.....
.....
I learn best when
.....
.....
.....
.....

Teacher`s Questionnaire "Effective Learning Research" Phase 1. J.Lane ECU

Current understandings about learning.						
		Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
7	I feel very confident that I can determine the learning styles and needs of learners in my class.					
8	I am well informed about my own learning style and preferences.					
9	Knowledge of my own learning strengths and weaknesses will help me to understand the learning strengths and weaknesses of learners in my class.					
10	Teachers can help learners to learn more effectively by making them aware of their learning styles and preferences.					
11	I am able give the learners in my class personalised information on how they learn most effectively.					
12	I have a good understanding of how to cater for the range of learning styles and needs of the learners in my class.					
13	I can confidently adapt my teaching so that it caters for the learning styles and needs of learners in my class.					
14	I consider the learning styles of the learners when planning assessment tasks.					
15	The way I was taught at School and University influences how I teach.					
16	My own learning style influences the way I teach.					

Professional Development						
		Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
17	I would like to be able to give the learners in my class personalised information on how they learn most effectively.					
18	I would be interested in practical strategies based on the current research to help me plan effectively for diverse classes.					
19	I would be interested in receiving more information on how to determine the learning styles and needs of learners in my class.					
20	I would be interested in receiving information on current research on brain development and its implications for teachers.					
21	I would like to receive more information on how to adapt my teaching to cater for the learning needs and styles of the range of learners in my classes.					
22	I would like more information on using multiple assessment methods to suit the learning styles and needs of the learners.					

Thank you for completing the questionnaire.